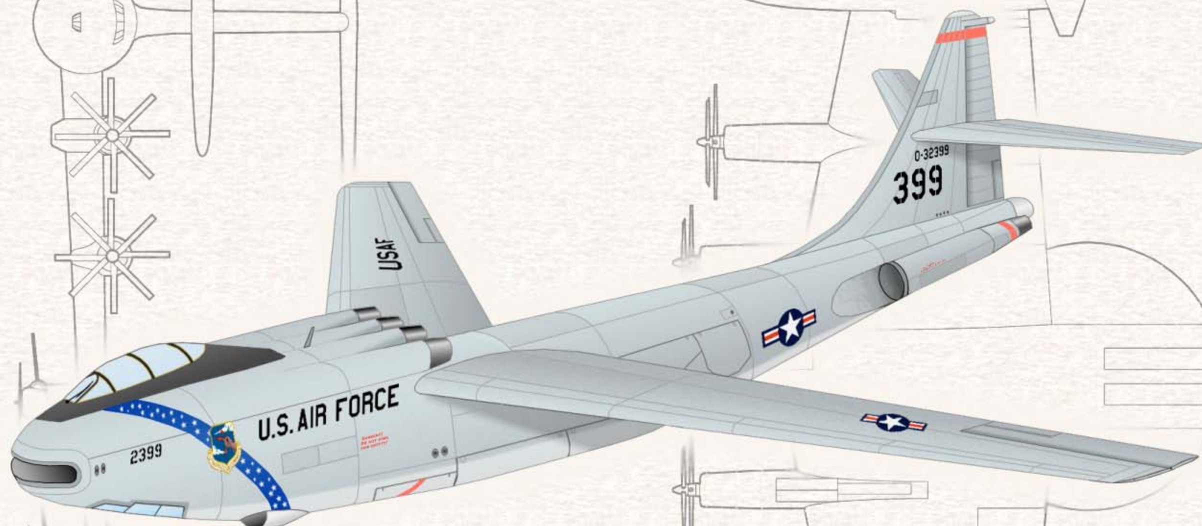
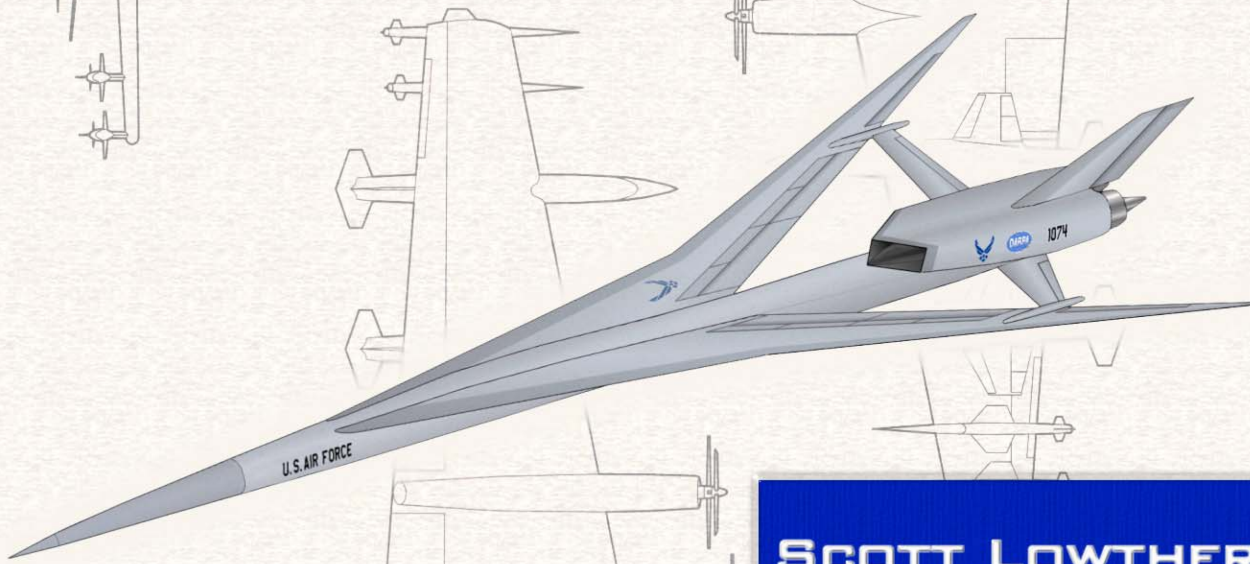
U.S. Bomber Projects

Preview





Scott Lowther

This book would not have been possible without the assistance of a number of individuals and institutions. Thanks are due: Stan Piet (of the Glenn L. Martin Museum); Michael Lombardi (of the Boeing Historical Archive); Dennis Jenkins; Robert Bradley (of the San Diego Aerospace Museum); NASA Center for Aerospace Information; Defense Technical Information Center; George Dyson; Pete Cluckey

scottlowther@ix.netcom.com
http://www.up-ship.com

Scott Lowther
11305 W 10400 N
Thatcher, UT 84337

This short booklet is a preview of a work in progress… “US Bomber Projects Since WWII.”

“US Bomber Projects” will attempt to describe the competitors and evolution of every major American bomber projects since the end of the Second World War… and many minor efforts as well. The well known projects will be covered, such as the B-52 and the B-1, as will lesser known programs such as the evolution of the Dyna Soar from its Bomber Missile days.

The final book will be far larger than this preview, and will put each design in its proper context. All designs will be illustrated with drawings and art such as are in this preview. All of these are brand new, made specifically for this book. The intent is to provide consistent, high quality and, importantly, accurate drawings that are bigger than the postage-stamp sized drawings generally presented. In the final book the drawings might not always be full page like these, but the intent is that they will at least be half page.

The drawings are slow to make, and are as accurate as I can make them. However, not all of the designs come equipped with detailed layout drawings… some have only crude sketches. Consequently, all drawings will have an indication of the “reliability” of the drawing, through a simple grading system, 1 through 5.
A “source grade” of 1 indicates that the drawing is a provisional reconstruction, based on text description, not actual drawings.
A “source grade” of 2 indicates that the source drawing is at best crude, often a notional design with just a sketch.
A “source grade” of 3 indicates that the source drawings are serviceable but simple.
A “source grade” of 4 indicates that the source drawings were clear, but the design was not entirely detailed.
A “source grade” of 5 indicates that the source material was detailed, clear and unimpeachable.

This is, of course, wholly subjective…

The designs in this Preview were chosen to cover a wide range of topics and originating companies or organizations

Scale bars are in meters.

The cutaway drawing of the Boeing Model 813 was produced especially for this work by Damon Moran. It is shown a little bit incomplete, due to schedule pressures. It is my hope to include a number of other cutaways, illustrating a range of vehicles.

If you would like to contact Mr. Moran, his email address is: **trigonometry@sbcglobal.net**

Section: Nuclear Powered Bombers
Subsection: Project Pluto

Pluto was a project to develop a nuclear ramjet-powered cruise missile. In the years before the Atlas and Titan ICBMs showed that good accuracy was possible with ballistic missiles, intercontinental-range supersonic cruise missiles were seen as the only alternative to manned strategic bombers. Missiles such as the Mace, Matador, Regulus and Navajo were developed to fulfill this role. These and similar missiles are not covered in "US Bomber Projects" as they were not strictly speaking bombers… the warheads were integrated into the vehicle structure and the missiles were intentionally sacrificed to take out one single target with one single bomb.

Pluto, however, was different.

Instead of a turbojet or ramjet, Pluto was to use a nuclear ramjet. A nuclear reactor would be built that would use air as its coolant; in the process of cooling the reactor, the air would be superheated. This fairly simple concept would, in theory, produce substantial thrust if contained in a proper ramjet engine. The ramjet would run as long as the reactor stayed functional, theoretically for months. In practice the reactor would degrade fairly quickly, and at most several days of flight time would be possible. But these would be several days at Mach 3… enough to fly around the world many times.

Pluto will be included in US Bomber Projects because the designs considered for the project were typically "true" bombers, in that several hydrogen bombs would be carried on board and ejected; the Pluto would fly from target to target, dropping up to two dozen separate nuclear weapons. Since the vehicle would be flying at Mach 3 at near-treetop-level, the shockwaves, thermal pulse and radiation produced by the vehicles would cause considerable damage everywhere the Pluto roamed.

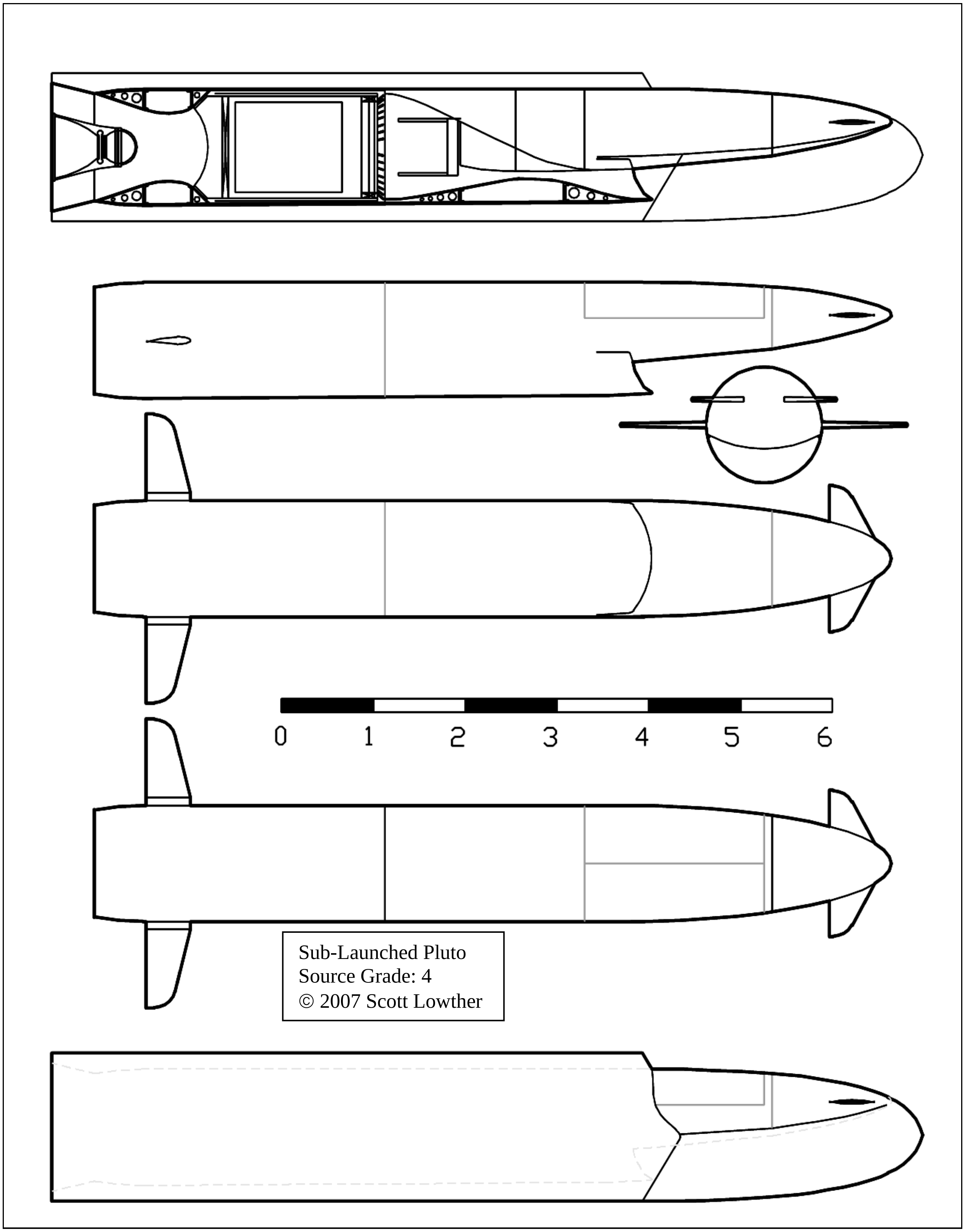
Several corporations and government facilities studied Pluto configurations; several of these will be described further in the book. Presented here, though, is one of the lesser-known configurations. Most Pluto vehicles were very large, requiring launch facilities similar to those required by the Atlas ICBM; but this design called for a fairly diminutive airframe… because it was to be launched from an unmodified submarine.

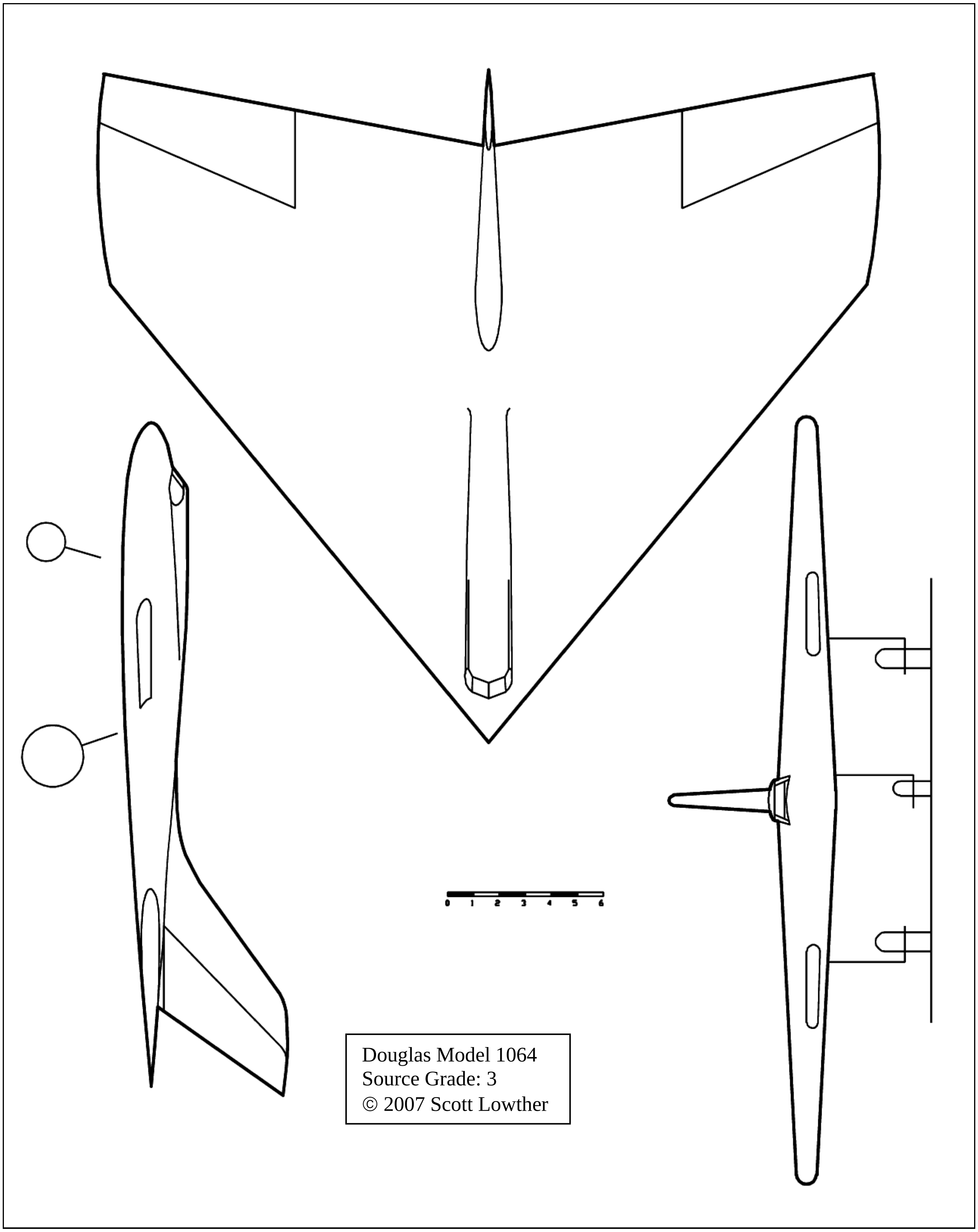
In order to fit within the confines of a Polaris submarine-launched ballistic missile tube, this 54-inch-diameter variant made maximum use of available volume for booster rocket propellant storage. Produced for the US Navy in 1962 by US Navy staff working with the Lawrence Livermore National Laboratory, this design was quite small by typical Pluto standards. The reactor, 46 inches in diameter, needed to run relatively hot (compared to the other typical Pluto reactors) in order to provide adequate performance. Mach 3.8 dash speeds at sea level were planned, with sea level cruise at about Mach 3.0.

For launch, a single rocket engine of 130,000 pounds thrust would burn for 60 seconds to get the vehicle up to speed where the ramjet could take over. It was expected that the reactor would take 40 seconds to get to full temperature. Propellants for the rocket, red fuming nitric acid (oxidizer) and 50% unsymmetrical dimethyl hydrazine/50% JP jet fuel (fuel) were to be carried in jettisonable tanks. Two sets of tanks would be carried… a “chin” tank which would be emptied of propellants and jettisoned as soon as possible to allow for air flow through the inlet (with the ramjet exhaust flowing around the rocket engine), and a “slipper” tank that wrapped around the bulk of the vehicle. The small wings would be folded against the side of the vehicle and actually immersed within propellant.

Land-basing was also considered feasible… either by using complete Polaris missile tubes located in inland water sites (lakes and flooded quarries), or in more conventional silos. However, this Pluto variant would have suffered exactly the same problem as the others when it came to inland basing… crossing friendly territory with a wildly radioactive vehicle. The nuclear bombs were to be carried in a bay in the nose, ejection method undefined.

Length: 30 feet
Flight weight: 27,500 lbs
Weapons: 1 32-in dia, or 2 21-in dia., or 6 15-in dia weapons. Total yield, 10 megatons.


0
1
2
3
4
5
6
Sub-Launched Pluto
Source Grade: 4


Douglas Model 1064
Source Grade: 3
© 2007 Scott Lowther

Section: B-52 Competitors and Evolution
Subsection: Douglas Model 1064

One of the prizes brought back from Germany after WWII was data on delta wings generated by Alexander Lippish. As with swept wings, delta wings showed great promise for high speed flight, and American aeronautical companies set out to exploit the new potential. Douglas designers were no exception.

In 1947, Douglas designers sketched out the Model 1064 series. A number of different designs were produced, all based on the theme of a turbojet powered delta winged strategic bomber. Interestingly, the design was not unique… the first of the designs was geometrically very similar to the Douglas D-571, the basis of the F4D Skyray fighter. The designs varied somewhat, but were all of a sort… a simple, fairly featureless delta wing with engines buried within and given a central fin. Detailed vehicle and program data is not currently available.

Span:	97.0 feet
Length:	83.5 feet
Wing Area:	4700 sq. feet

US Bomber Projects will include drawings on several more versions of the Model 1064

Section: B-58 Competitors and Evolution
Subsection: GEBO/ Douglas Model 1186A

Poorly documented, the Douglas Model 1186 was a multi-stage manned bomber design, circa 1949. The USAF was looking for a long-range bomber with supersonic target zone performance but the propulsion technology of the time was incapable of fulfilling that role. As a consequence, many multi-stage bomber designs were put forward… typically they would use large subsonic aircraft carrying smaller supersonic dash bombers.

Convair led the aeronautical community with its work on the GEBO (Generalized Bomber) studies, beginning in 1946. Convair produced many designs under GEBO, perhaps the most important of which was a “parasite” bomber. Carried by a B-36, the manned plane was delta-winged and similar to the XF-92, with a three-engine jettisonable pod providing the bulk of the supersonic propulsion to the target. The Douglas company produced a somewhat similar design in the form of the Model 1186, though with a derivative of the X-3 as the manned component. An enlarged X-3-type vehicle served as the propulsion/weapons component – and would work like a supersonic cruise missile after separation. The manned plane would return at supersonic speed.

The manned component had a crew of two, and, in the 1186A, was carried on top of the weapons component vertical fin. The 1186B located the manned vehicle on a centrally-located pylon; the 1186C stacked two of the weapons components engines on top of the fuselage, forming a large fin for the manned component to attach to; the 1186D blended the two components together into an aerodynamically unified vehicle.

The available drawings show neither landing gear nor room for landing gear on the weapons component. Clearly the vehicle, like the Convair design, must have been carried by a third aircraft. The layout of the Model 1186 series indicates that, unlike the Convair parasite (which was carried under the B-36, semi-recessed into the bomb bay), the Douglas vehicle was carried above its transport. The carrier aircraft is not defined in the available documentation, but could have included the B-36, the Douglas Model 1211 strategic bomber (a B-52 competitor), or some other aircraft.

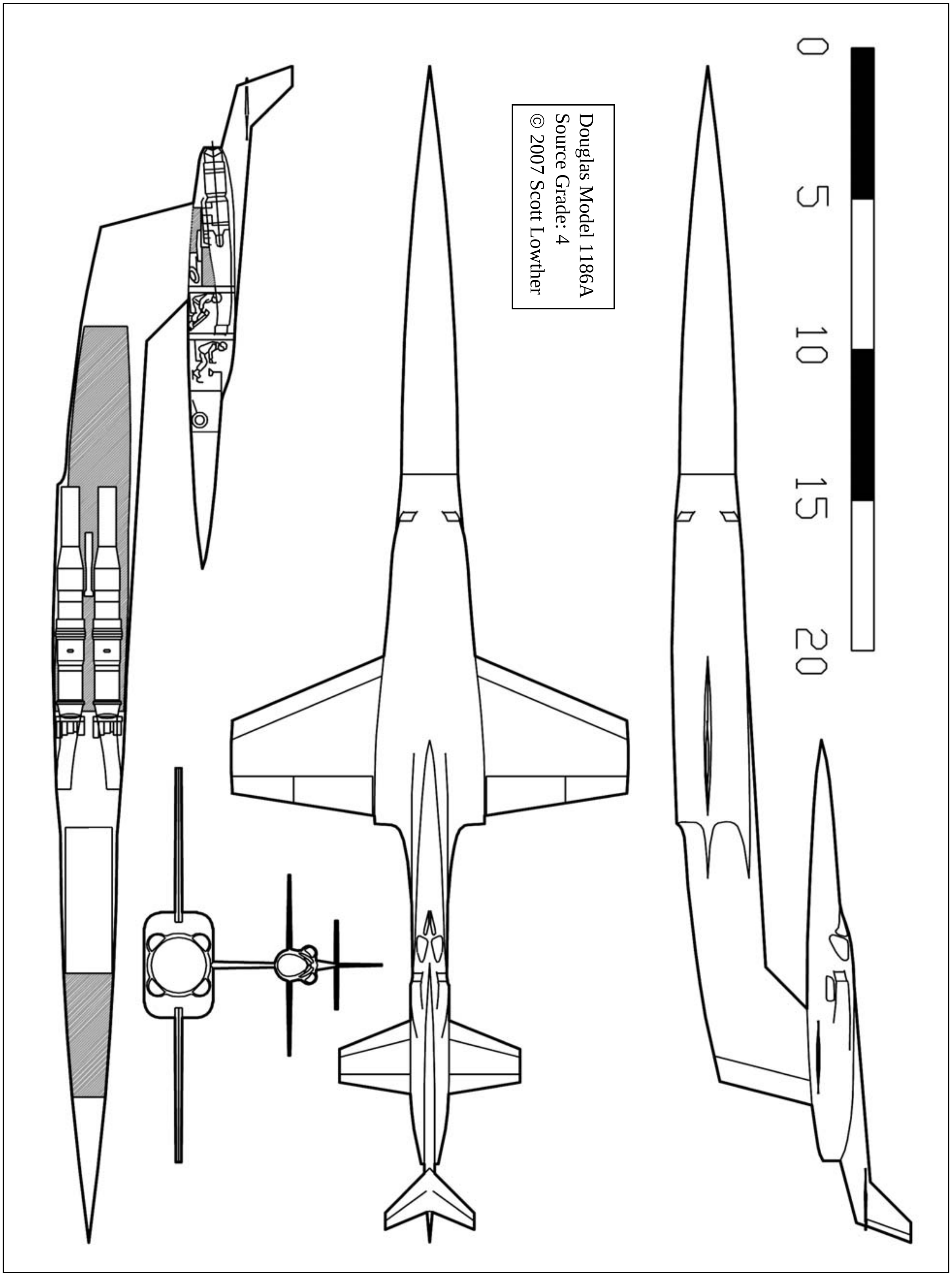
Manned component:

Length:	54.4 feet
Span:	19.3 feet
Engine:	1 Westinghouse X-24-C-10

Bomb Component:

Length:	110.5 feet
Span:	42.5 Feet
Engines:	4 afterburning Westinghouse XJ-40

US Bomber Projects will present drawings of many more Model 1186 variants, and, hopefully, more data.


0
5
10
15
20
Douglas Model 1186A
Source Grade: 4
© 2007 Scott Lowther

Section: Miscellaneous Bombers
Subsection: NASA Bomber

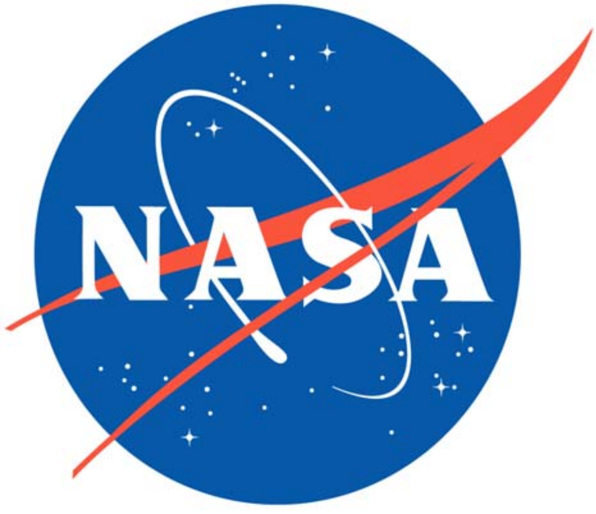
Many bomber designs fit into no convenient categories. This could be because they were minor efforts at a government or corporate office, not meant to answer a specific requirement; or because the intervening years have obliterated the supporting documentation and programmatic links, leaving only the raw design data. Rather than simply ignore these designs, "US Bomber Projects" will bring a number of the more interesting of them out into the light.

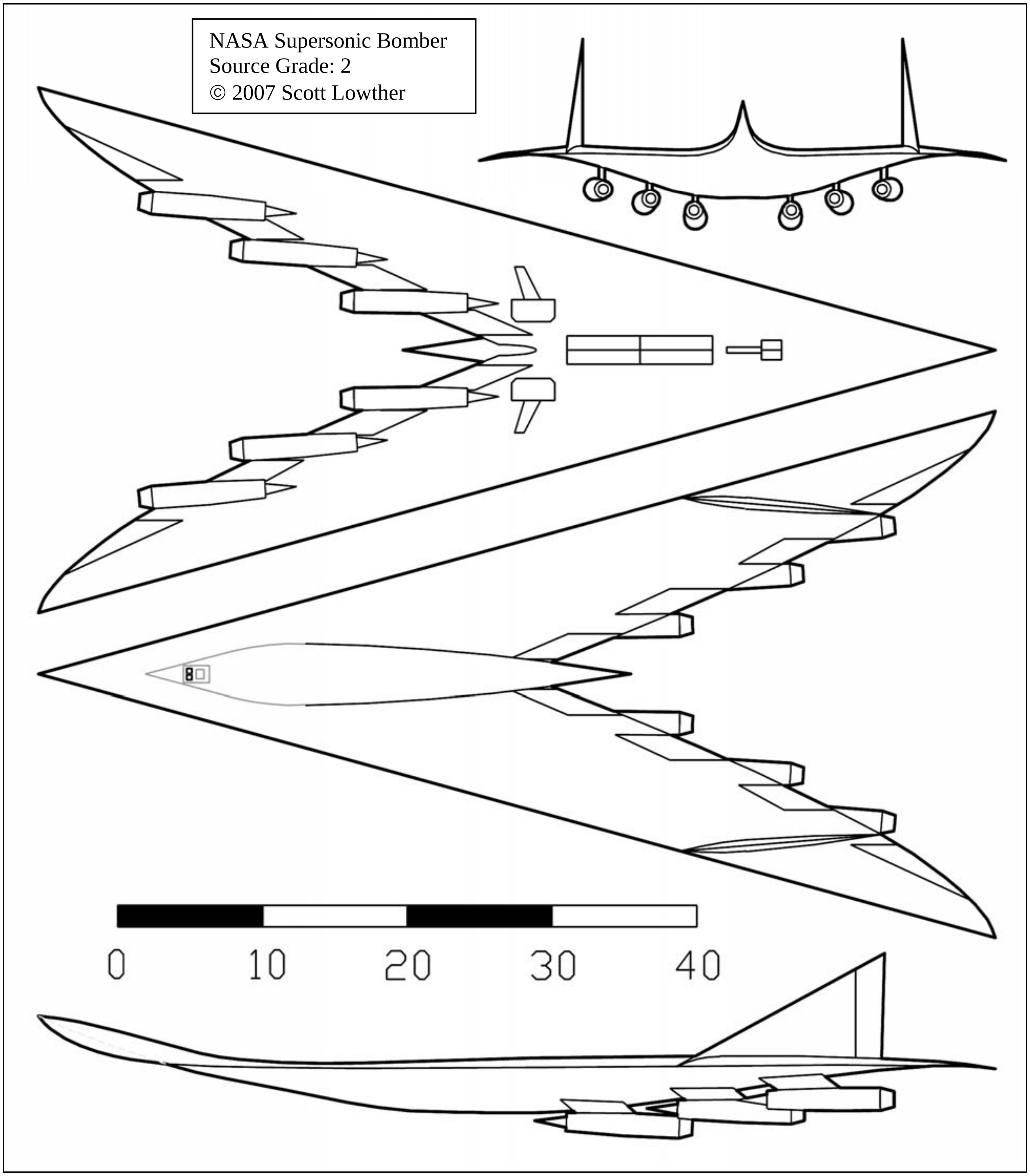
The vast majority of bombers, and indeed aircraft, that are designed fade into obscurity. Even designs that make it into full production often vanish from public memory. Very rarely, though, an unbuilt project leaves some lasting memory… even if it's not remembered as what it originally was meant to be.

One such design was incorporated into the NASA (and NASA Director) logo. The NASA "Meatball" design contains a blue circle, the NASA acronym, stars, an orbital path… and an organic red chevron. The red chevron is an interesting artistic flourish… but it had a basis in history. Specifically, the red chevron is modeled on a wind tunnel model of a supersonic wing shape tested at Langley Aeronautical Laboratory in 1958, during the last days of the NACA. The wing was very complex in layout, and meant to perform well at high speed. At the time, it was merely one of a number of configurations studied for future high speed aircraft.

The bomber designs resulting from this study appear to be highly hypothetical and generic, but the association with the NASA "meatball" grants a definite amount of historical interest to the concept. Wind-tunnel tested as just the bare wing, as a full aircraft configuration with separately podded engines and as a full aircraft configuration with the engines clustered in a single central pod, the intent was to produce a design with a cruise Mach number of 3. It is unclear if a true, detailed design was made for an operational aircraft, or if – as is more likely – these models merely represented vague configuration possibilities. No data was given to define the full-scale dimensions of the aircraft; the reconstruction is thus highly provisional, and size is based on scaling the engine pods to those of similar contemporary high-Mach designs.

Unfortunately, wind tunnel testing showed that drag was substantially higher than anticipated (although no worse than for other, more conventional configurations). This, along with the geometric complexity of the design, helped assure that the design would get nowhere near production. But the unique geometry did catch the eye of the graphic artists at NASA, and survived to the present day in an unexpected way.




NASA Supersonic Bomber
Source Grade: 2
© 2007 Scott Lowther
0
10
20
30
40

Section: Space Bombers
Subsection: Orion

Orion was the most powerful space propulsion system ever seriously considered. The concept is quite simple: detonate an atomic bomb close enough to a vehicle and the blast wave will push very hard, very fast. This was realized by scientists and engineers working on the Manhattan Project, with the initial proposals to study vehicle applications put forth in memos by Stanislaus Ulam in 1946. The following year Ulam and F. Reines of Los Alamos Scientific Laboratory produced a memo with basic calculations. In 1955, Ulam and Cornelius Everett produced a mathematically more detailed paper describing a launch vehicle concept that used fifty small atomic bombs to loft a payload to escape velocity. While this vehicle was quite vague and of limited value, the concept was seen by many as valid. When in October of 1957 the Soviet Union launched the first artificial satellite, the importance of powerful propulsion systems was impossible to ignore.

Even forty years later, much of the history of Project Orion remains clouded in secrecy. This is due to the nature of the concept and the organizations that paid for the studies (the USAF and ARPA).

Project Orion was conceived in late 1957 by nuclear weapons designer Ted Taylor. Working at General Atomics, Taylor had the advantage of weapons design experience and could see how improved atomic devices could improve the performance of the Ulam/Everett vehicle. General Atomics provided initial funding to study the idea; by April of 1958, enough data was available on the concept to allow Taylor to give a presentation to the Advanced Research Projects Agency (ARPA). The program was funded by the USAF for several years to come.

In the early years of Project Orion, the concept was touted as the answer to the USAF's supposed need for a "space battleship." Unfortunately, very little detailed engineering design work has come to light on these USAF projects. The battleship was a ground launched Orion that self boosted into Earth orbit; from that point, its role would probably be to serve as an anti-ballistic missile platform. Payloads could be up to 1,000,000 kilograms. *Note: US Bomber Projects will present further information on the "space battleship."*

Unfortunately for Taylor and the "space battleship," the USAF saw little need for such a device. Around the same time, the USAF was funding the Dyna Soar project, which would eventually be terminated in 1963 for lack of a perceived mission; the Dyna Soar was replaced by the USAF Manned Orbiting Laboratory (MOL), which would also be cancelled for lack of a perceived mission. The 1960's were not good to advanced manned space projects, especially in the United States Air Force. Air Force funding for Project Orion dried up in 1963.

Fortunately, in June of 1963, NASA somewhat reluctantly gave a contract to General Atomics to study the Orion concept for manned missions to Venus, Mars and Jupiter. The additional funding that NASA gave to the Orion project allowed General Atomics to continue studying alternate uses, including military uses.

The only known design for a true Orion bomber was described in limited and sketchy detail as a Strategic Weapon System in a General Atomics report. This concept, foreseen as a fulfillment of an expected Strategic Air Command strike capability for the post-1975 period, dated from 1965. This was at the end of the Orion program.

This called for a 12-meter diameter vehicle, larger than the 10-meter vehicle proposed to NASA for initial development. It was to be geometrically simpler than the NASA vehicle; the forward section of it would be faired in completely, providing an aerodynamically clean surface for the initial launch to orbit, as well as protection of internal structures, propellant, weapons and crew from micrometeoroids. As the craft would operate beyond the Earths magnetosphere, the crew would require substantial shielding to protect them from cosmic rays and ionizing radiation.

While the early Orion concepts called for self-launching the vehicle from the ground, it quickly became apparent that lofting the vehicle at least partially to orbit before firing up the main engine would be cheaper, easier and environmentally safer. The bomber vehicle was to be lofted by a cluster of seven 156-inch diameter solid rocket motors. This type of motor received considerable study during the 1960s for both USAF and NASA heavy-lifter duty; larger and more powerful than the Shuttle booster rockets, the 156-inch motors were nonetheless not the largest seriously considered. That honor fell to the 260-inch diameter solid rockets.

The 156-inch motors were a serious effort (with considerable development and testing by Aerojet, United Technologies, Lockheed and Thiokol) and would have proven more powerful than the solid

rocket boosters used on the Space Shuttle. Consequently, the ground launch of an Orion bomber would have been a spectacular sight. Burn time would have been somewhat longer than two minutes, lofting the bomber far into the sky… but also far short of orbit. The bomber would have had to fire up its nuclear pulse engine while still in the very high atmosphere; another spectacular sight would have followed as a sub-kiloton nuclear device would be detonated about once every second until the craft had attained its intended trajectory.

The rockets would boost the Orion to an altitude of 250,000 feet and a speed of 10,000 feet/second; after staging, the Orion would boost under its own power to low Earth orbit. After system checkout, the Orion engine would again be used to boost the vehicle to a 100,000 n.m. apogee Hohmann transfer orbit, and boost again at 100,000 n.m. to circularize the orbit. The Orion would be used once again to put the ship on an orbit with a 100,000 n.m. perigee and with an apogee beyond lunar orbit. Once there, a maneuver delta V of 75,000 feet/second would be available.

The vehicle would have had a vacuum thrust of 970,000 pounds, a specific impulse of 3,670 seconds and a gross weight of 1,750,000 pounds. The total liftoff weight including the solid rocket boosters was 15,000,000 pounds. Payload delivered to the 100,000 n.m perigee elliptical orbit was to be 300,000 pounds.

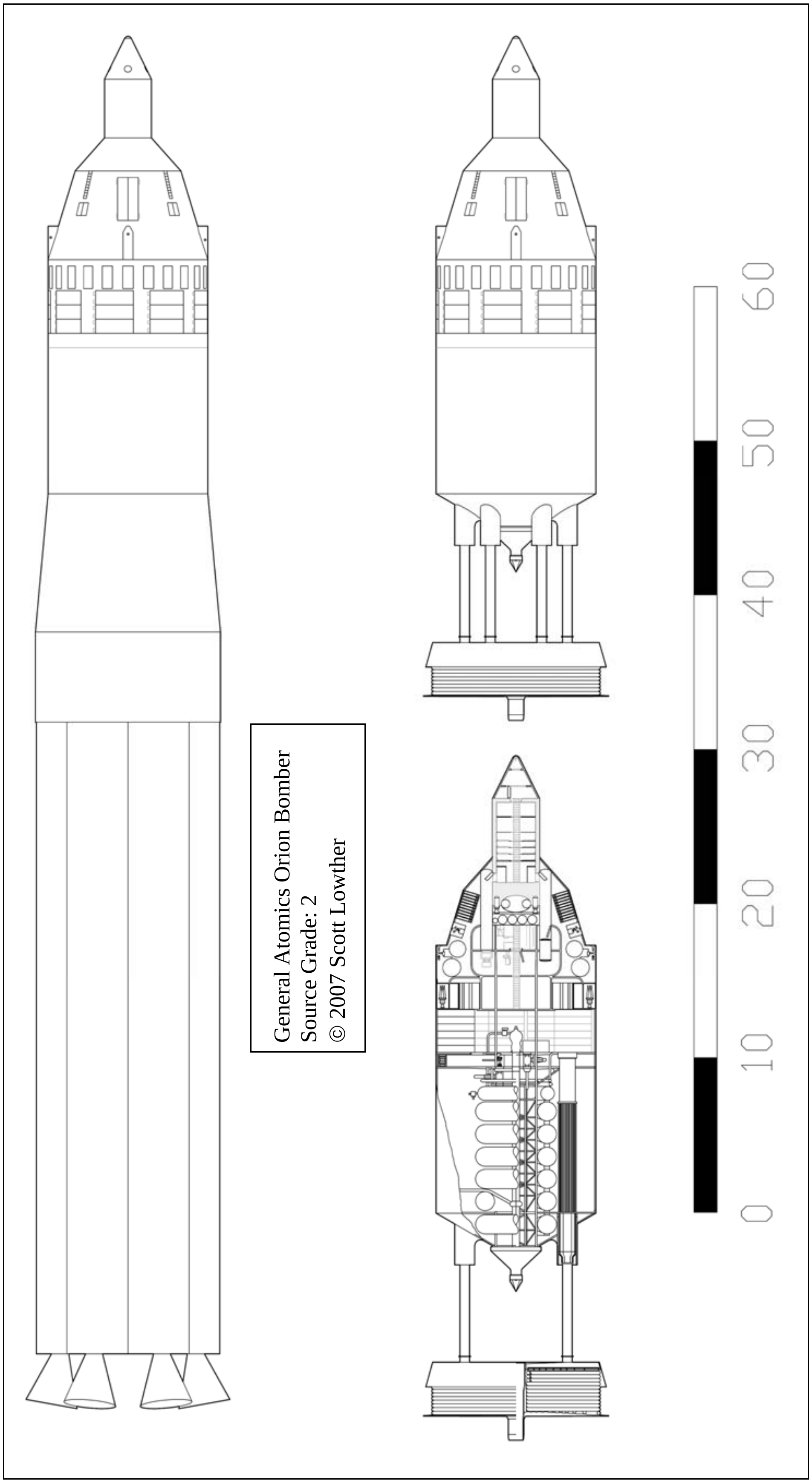
Crew complement was to be 20 or more, the exact number to be determined. Flight operations would of course have been 24/7. A semi-closed ecological system would have been employed to permit a normal on-site duty cycle of six months, with an emergency capability of one year. The subsystems were to be designed for easy replacement as they wore out or became obsolete.

The planned weapons capability was not defined in any detail. However, the offensive weapons were to be carried internally, and fully accessible by the crew to permit maintenance. Unspecified defensive capabilities were also to be carried. The offensive weapons (surely to be megaton-range nukes and/or vast numbers of smaller nuclear weapons) could be launched one of two ways:

1) Using rocket motors, the weapons would be launched from deep space. They could be guided to their targets.
2) The weapons could be released from the Orion near Earth. The Orion would use its considerable propulsive capabilities to boost itself from deep orbit to a close hyperbolic flyby of the Earth

The deep-space strategic weapons would have been more difficult for the enemy to attack than ICBMs in silos or nuclear submarines… at vastly greater cost and complexity. Such a system would have been a major escalation of the arms race, and would have required wholly new logistics systems, crews and strategic planning.

US Bomber Projects will include further information and drawings on this Orion design.


General Atomics Orion Bomber
Source Grade: 2
© 2007 Scott Lowther
0
10
20
30
40
50
60

Section: Space Bombers
Subsection: X-42

The Orbital Sciences Corporation (OSC) X-42 was designed circa 2003 as an unmanned Reusable Access to Space technology demonstrator. It was a reduced-scale version of a two stage to orbit concept that was designed under NASAs Space Launch Initiative program, and further modified refined under the United States Air Forces Advanced Space Launch Study for military purposes. Even though the X-42 was meant as an experiment, it nonetheless was capable of fulfilling an operational offensive military role.

The Orbital Sciences take on the X-42 is conceptually very similar to the Rockwell X-33 configuration and its proposed single stage to orbit follow-on launch vehicle. In short, both the OSC X-42 and the Rockwell X-33 were fairly simple geometries… cylindrical and fairly stubby fuselages with rounded noses, low-set clipped delta wings, a single centrally mounted shuttle-like vertical tail and a single conventional rocket engine. This is not the sexiest configuration for a reusable launch vehicle, but it is straightforward and simple, with reasonably good mass fractions.

The OSC X-42 was designed for trajectory versatility, rather than to fly one specific mission. This would allow it to serve as a "scalable and traceable" RLV prototype that would be capable of operational use. On its own, it could attain a speed of Mach 10, or reach Mach 6.5 carrying 13,000 pounds of upper stages and payloads. For satellite launch and weapons delivery, the X-42 would use the solid propellant second and third stages from the OSC Pegasus launch vehicle. The X-42 could serve as, effectively, a partially reusable ICBM. The X-42/upper stage vehicle could launch a single Common Aero Vehicle (CAV). The CAV is to be a hypersonic lifting body shell, meant to extend via gliding the range of conventional or nuclear explosives. Range for the complete X-42/CAV system was described as "intercontinental."

Main propulsion was provided by a single Rocketdyne RS-27 rocket engine burning liquid oxygen and RP-1 (basically kerosene). The full-scale SSTO vehicle would use oxygen and hydrogen, but for this smaller and lower-performance vehicle, RP-1 would not only provide adequate performance but would also be safer and more convenient. Maximum sea-level thrust for the RS-27 is 200,000 pounds. Reaction control was to be provided by high-pressure nitrogen cold-gas thrusters.

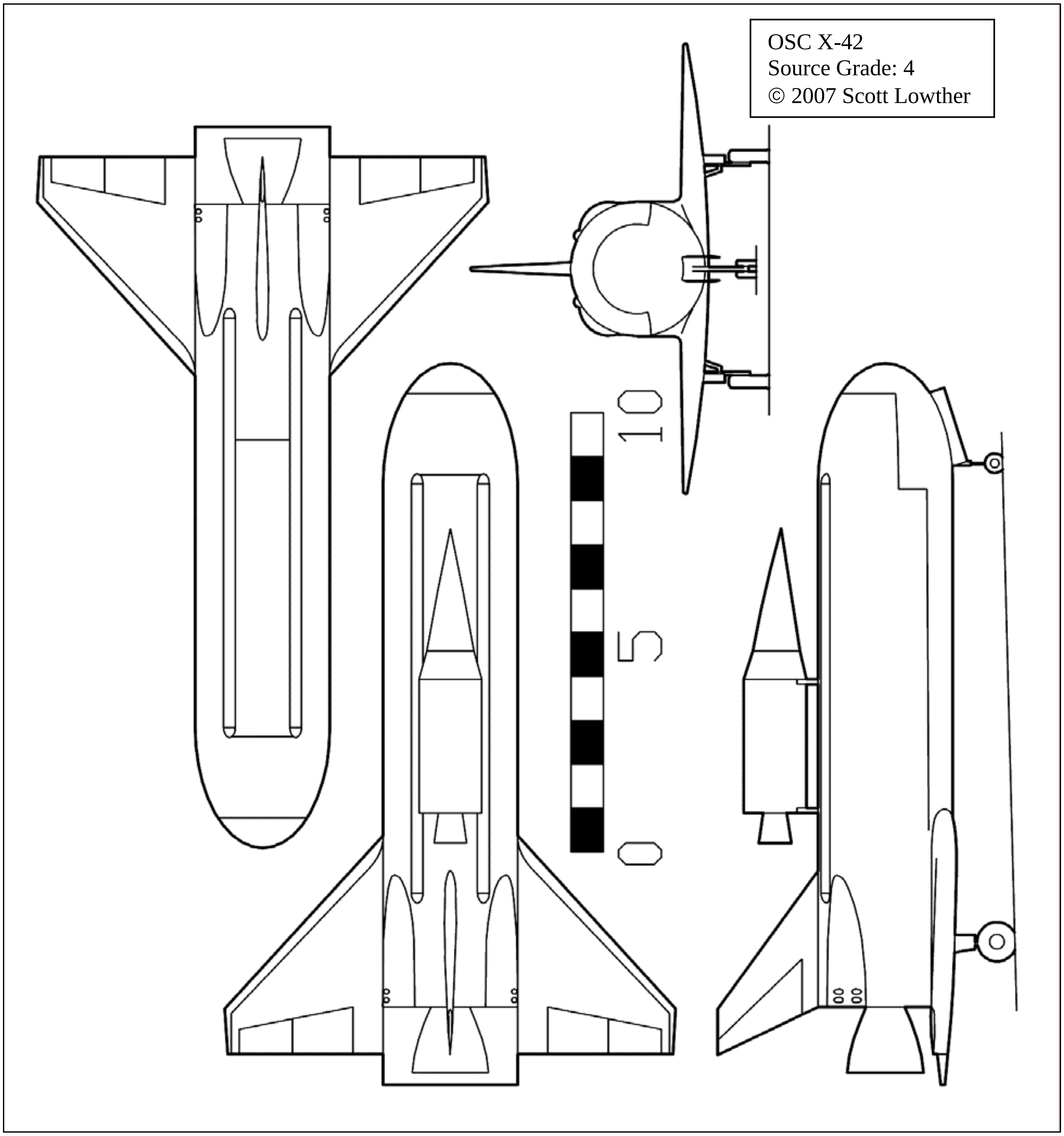
Orbital Sciences had previously designed and built (but never flew) the X-34 spaceplane. Many of the lessons learned on and subsystems designed for the X-34 were to be applied to the X-42, including the avionics suite, structural fabrication techniques, even the flight termination system (rather than destroying the vehicle with explosive charges, the X-42 would be put into a high rate of roll which would effectively allow it to follow a ballistic trajectory to an ocean impact).

The landing gear uses mains from the F-15 and nose gear from the Saab 2000. These are capable of taking substantially more weight than the empty weight of the X-42, so intact abort with the payload still attached was possible. To minimize landing run, a braking chute was to be located in the aft fuselage

It was expected that the X-42 would require 14 days of processing between missions. It is interesting to note that this is about what the Space Shuttle was originally expected to require between missions.

OSC X-42	
Span:	33.7 ft
Length:	53.9 ft
Empty weight:	23,170 lbs
Gross weight (w/CAV):	148,220 lbs
Gross weight (demonstrator):	134,820 lbs

US Bomber Projects will provide further information on both the OSC X-42 as well as other companies designs for the X-42 and the CAV.



OSC X-42
Source Grade: 4
© 2007 Scott Lowther

Section: B-47 Competitors and Evolution
Subsection: Boeing Model 448

The B-47 was an important step forward not only in bomber design, but in aircraft design in general. Evolved in many steps from the B-29, the B-47 eventually became an entirely different sort of plane from its predecessor. Given the importance of the B-47, it will have a sizable chapter in US Bomber Projects, covering the initial design evolution as well as advanced projects… from straight-winged prop-jobs to delta winged supersonic planes.

With the fall of Nazi Germany, American forces were able to scour Germany aeronautical facilities for documentation and personnel. Among the more important data uncovered was research into the aerodynamic advantages at high speed of swept wings.

The Model 448 (dated January 7, 1946) was described as a "Jet Propelled Medium Bomber" and was Boeings first documented bomber design to incorporate the German lessons in wing sweep. The late-1944 Model 432 was equipped with four upper-fuselage mounted jet engines, but as the limitations of the design became apparent, Boeing studied adding two more engines. Locations for the new engines included the unconventional… not only wingtips nacelles, but also tail horizontal stabilizer-tip nacelles. Wind tunnel evaluations led to an aerodynamically refined and structurally optimized design, the Model 448.

Four of the 4,000-pound thrust turbojet engines were fuselage mounted just aft of the cockpit, similar to the Model 432, and two were mounted in the tail cone. This left the wings remarkably clean. The forward engines were fed by a common inlet in the nose, forming what looked like a gaping mouth. The inlet bifurcated, providing a passageway between the cockpit and the bombardiers position. The crew compartment was pressurized, and the wings, unlike the straight wings of the Model 432, were swept aft to a large degree.

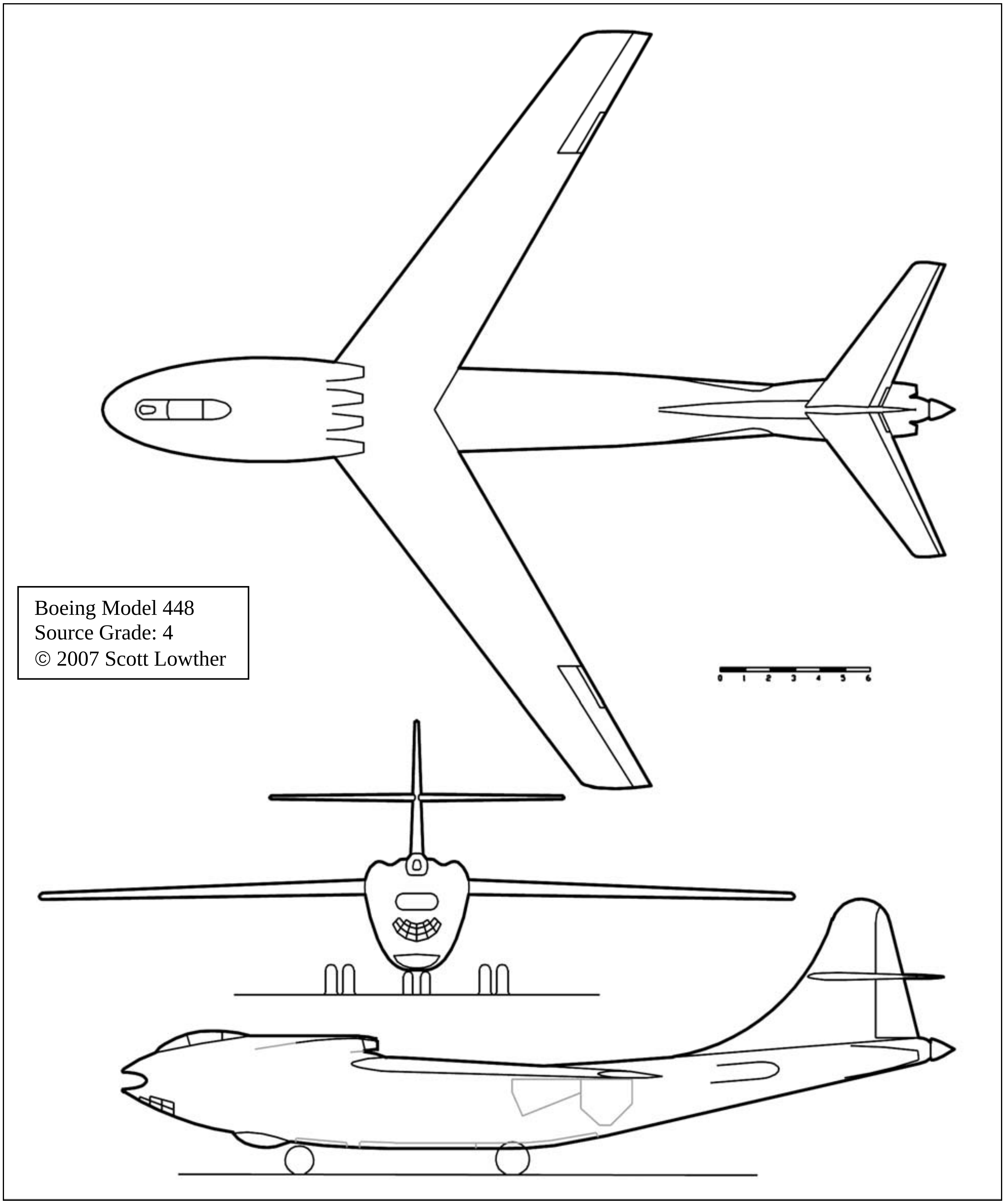
While the Model 448 does show some similarity to the B-47, major differences include more than just the unusual engine arrangement. The innovative bicycle landing gear the B-47 used had not yet made its entrance; the Model 448 instead used a more conventional tricycle arrangement.

Defensive armament for the Model 448 included two .50 caliber machine guns in the tail (contained within a jettisonable tailcone) with 600 rounds each. Offensive armament could be sixteen 500-lb bombs, eight 1000-lb bombs or a single 22,000-lb "Tallboy" bomb.

Span:	100'
Length:	109' 3"
Wing Area:	1300 sq. ft.
Crew:	3
Empty weight:	77,517 lbs
Useful load:	47,285 lbs
Max Gross Weight:	138,770 lbs
Leading Edge Sweep:	36° 38'
Aspect Ratio:	7.7
Engines:	4 GE TG-180
Range:	Not Given
Speed:	Not Given

Putting the engines on the top of the forward fuselage produces an immediately obvious problem: the jet exhaust blasting along the surface of the fuselage. Not only does this lead to the risk of structural damage through blast and heat, it also reduced engine performance. This odd design feature was inherited from the previous design, the Model 432. The Army Air Corps was understandably skeptical of the concept, and had Boeing go back to the drawing board. The fuselage-mounted engines were relocated to underwing pods in the Model 450… and the B-47 was born.

As well as the three-view, the Boeing Model 448 will likely be illustrated with an inboard profile and a perspective view. The B-47 genesis will be covered in depth, from wartime designs to later supersonic derivatives.


Boeing Model 448
Source Grade: 4
© 2007 Scott Lowther

Section: Miscellaneous Bombers
Subsection: Douglas MX-2091

In 1953 Douglas released the final report on the year-long Phase I of the MX-2091 design study, aimed at the eventual development of a subsonic manned low level strategic bomber/reconnaissance system. Recent advances in radar, anti-aircraft systems and supersonic interceptors were expected to make high-altitude strategic bombers problematic. The MX-2091 was to cruise at high altitude through safe airspace, then, when near and over enemy airspace, fly under defensive radar and avoid detection. To further aid survivability, the MX-2091 was to carry a single large missile rather than freefall bombs.

Douglas studied a wide variety of configurations. They started with a fairly conventional design (the MX-2091-A) featuring a slim fuselage, swept shoulder-mounted wings, a conventional tail and a single turbojet slung under each wing. The large missile was carried externally under the fuselage centerline.

Design elements were altered, the resulting configuration compared to the baseline "peg point" design, and evaluations made. Fundamental differences included substantial configuration alterations:
MX-2091-B: Delta wing
MX-2091-C: Straight wing
MX-2091-D: Fixed canard
MX-2091-E: Floating Canard
MX-2091-F: Turboprop
MX-2091-G: Three-engine
MX-2091-H: Four-engine
MX-2091-I: Internal missile bay
MX-2091-J: Over-fuselage missile
MX-2091-K: Floating wingtip fuel tanks

Further variants of the MX-2091-A included zero-length launch, two-missile stowage, podded underwing chaff dispensers, wingtip "ferret" direction finding equipment, a centerline refueling pod (to convert the MX-2091 into a tanker) and internal reconnaissance systems. Engine locations were also studied: most of the basic MX-2091-models used fairly conventional underwing nacelles, but also considered were wing root locations, on the wingtip, blended into the aft fuselage, fitted directly under the wing, and mounted within the wing much like on the Gloster Meteor.

After all the studies, the recommended configuration turned out to be very similar to the MX-2091-A. The recommended configuration featured what would be considered a broadly conventional layout. The most unconventional aspects were a cockpit very far forward, providing good downward visibility for landing, and defensive armament in the tail. Two 20mm T-31 cannon were located behind doors in the upper part of the tail cone; when needed, the doors would open and allow the cannon to emerge and track pursuing targets. The aircraft was designed for an initial operational capability of 1957. The cockpit featured side-by-side seating for two crew (with a third sitting just behind them) and ejector seats.

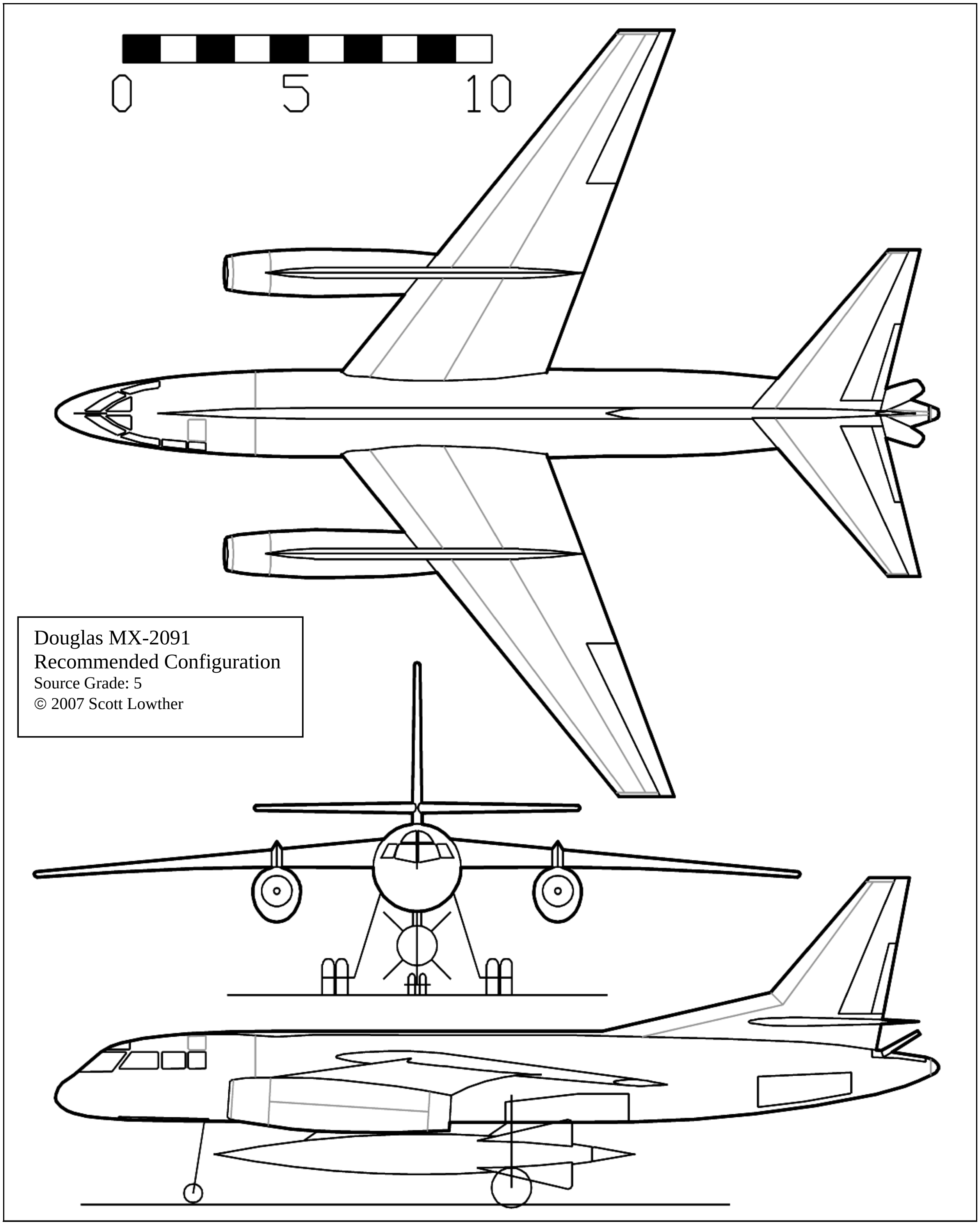
The engines would use afterburners for takeoff, but would cruise on dry thrust afterwards for maximum range. Fuel would be stored in the wings and fuselage; a refueling probe would allow for extended range.

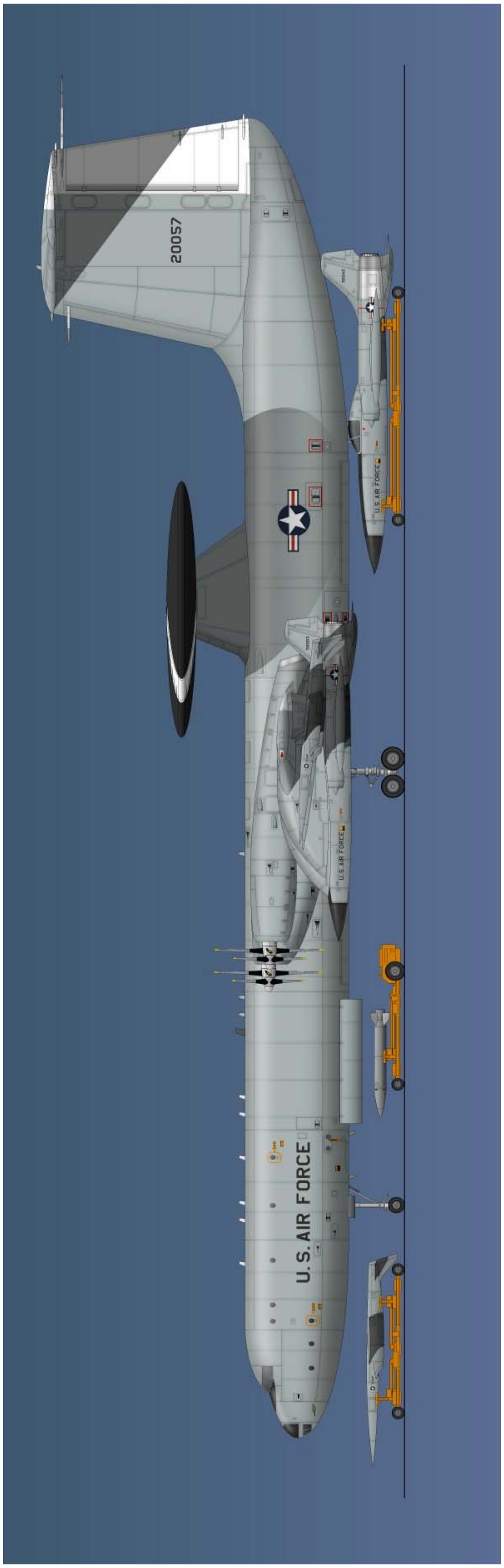
The missile was to be a geometrically simple ogival design 45 inches in maximum diameter and weighing 10,000 pounds. Other, geometrically similar, missiles of 31 and 60 inches diameter were also considered (design documentation on these missiles has not yet been found… consequently, propulsion, range, speed and payload for the missiles is not yet known). For recon missions, the missile would be replaced with a sensor pod roughly similar in size and shape to the missile.

Recommended MX-2091 Configuration

Span:	68.25 feet
Length:	78.7 feet
Wing Area:	850 sq. feet
Engines:	2 P&W J57
Crew:	3
Armament:	1 10,000 lb missile
Gross Weight:	155,000 lbs
Mission radius:	1300 n. mi. cruise, plus 800 n. mi. dash at Mach 0.85

US Bomber Projects will show the other MX-2091 designs.


0
5
10
Douglas MX-2091
Recommended Configuration
Source Grade: 5
© 2007 Scott Lowther



Color Section

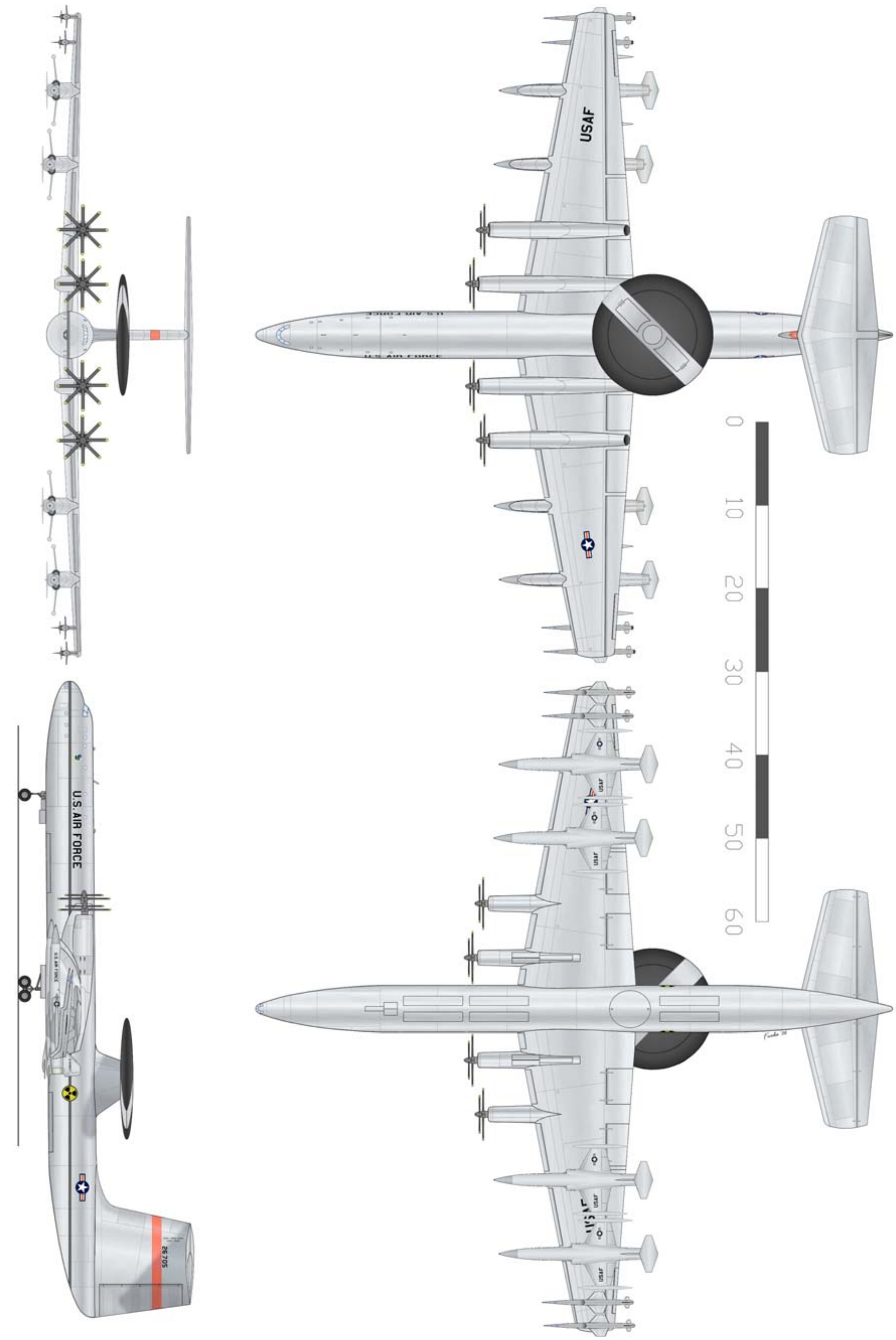
US Bomber Projects will contain artwork such as these for many of the bombers to be described. This will help to "put the flesh on the bones," so to speak.

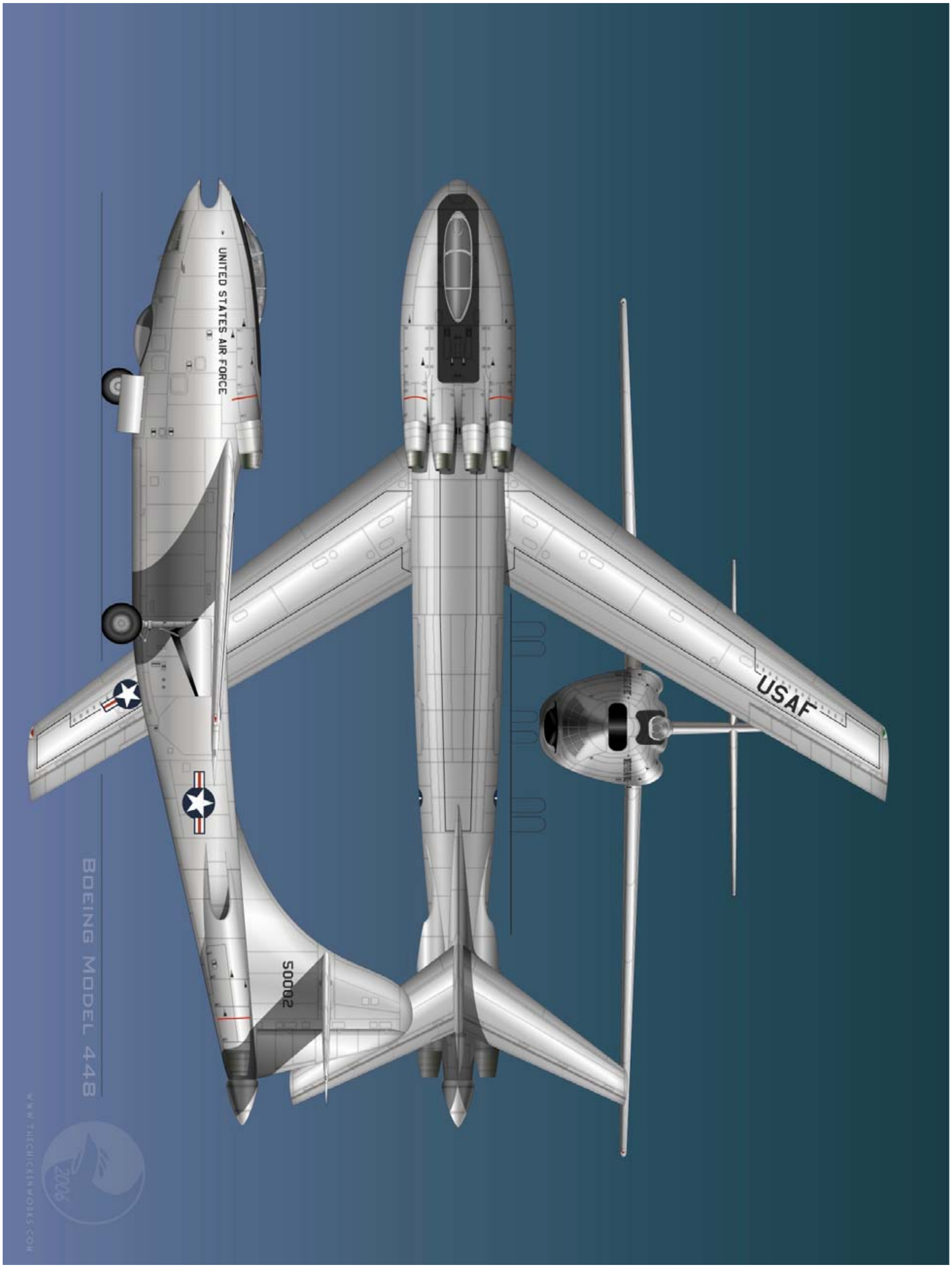
Shown here are six separate digital paintings representing three bomber projects, done by two separate artists. The intent was to allow the artists to display their skills in a head-to-head competition with direct comparisons. If you have a strong preference as to which artist/style you find most appealing, please let me know via email at:
scottlowther@ix.netcom.com

US Bomber Projects may feature one artist exclusively, or have a mix. That decision has not yet been made.

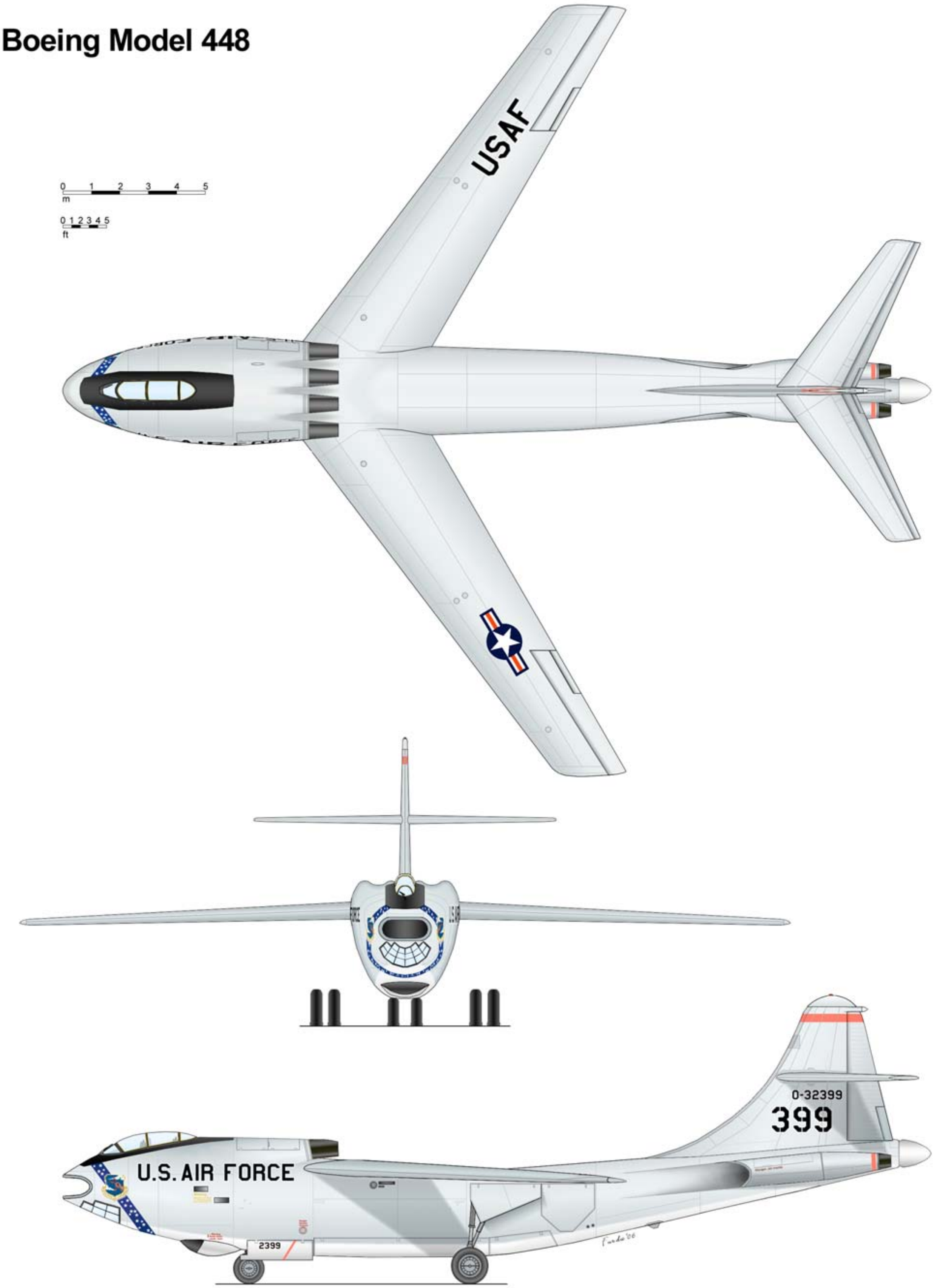
If you would like to contact the artists, their email addresses are:
J.P. Santiago sentinelchicken@gmail.com
(Work shown on this page)

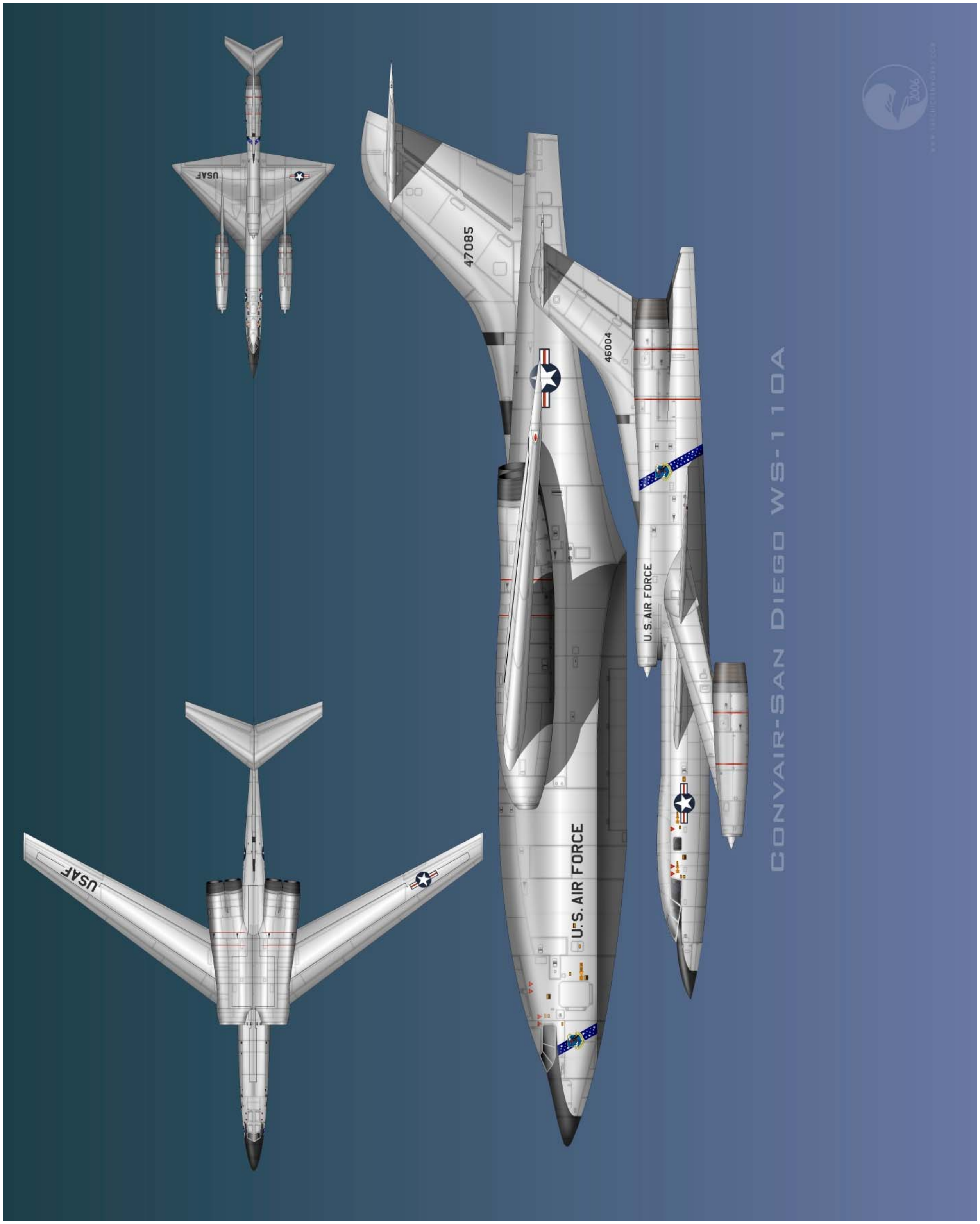
Matej Furda hitechweb@genezis.eu
(Work shown on opposite page and cover art/design)


USAF
U.S. AIR FORCE
0
10
20
30
40
50
60
26705

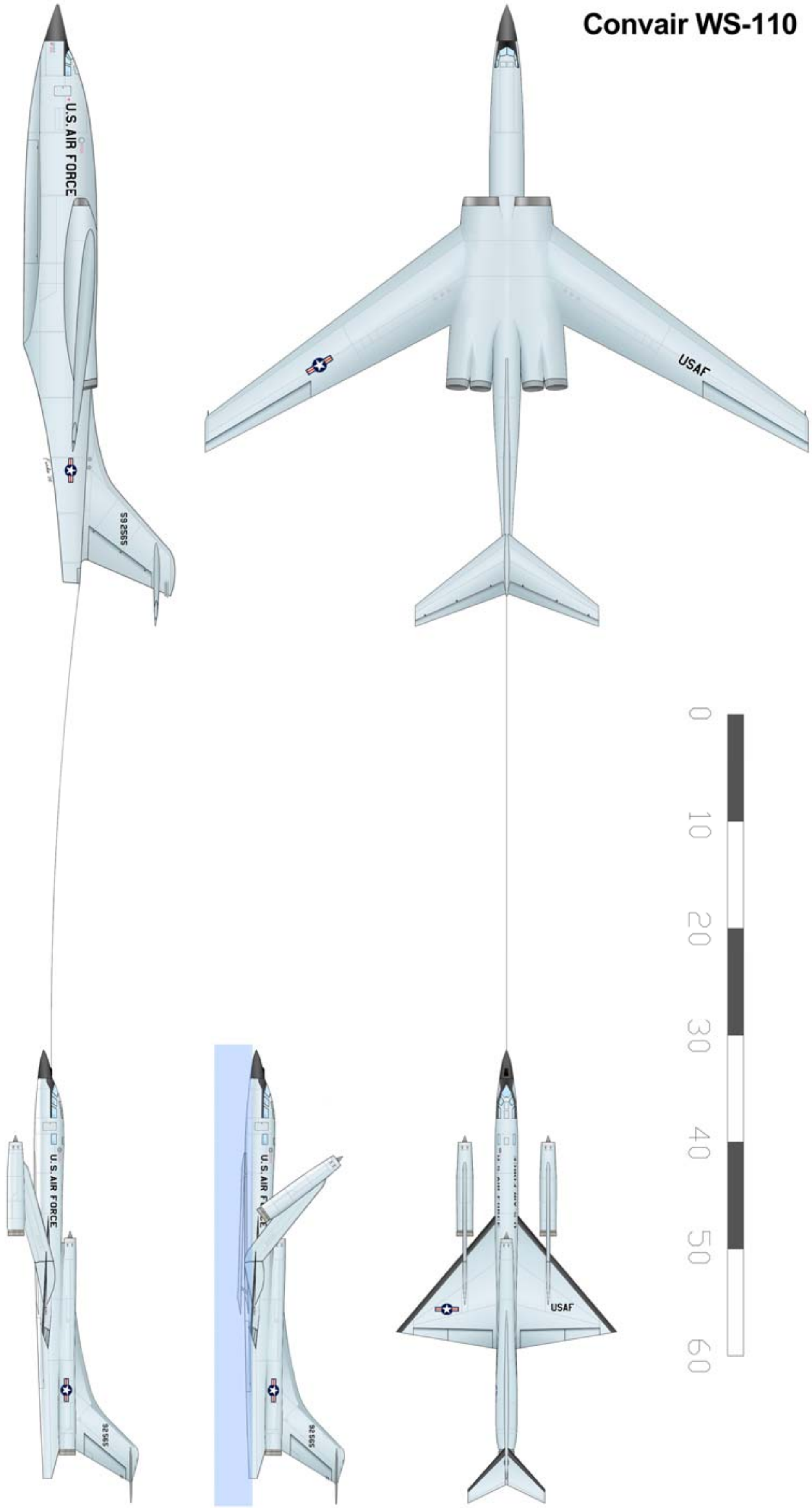

UNITED STATES AIR FORCE
USAF
50002
BOEING MODEL 448

Boeing Model 448




CONVAIR-SAN DIEGO WS-110A
U.S. AIR FORCE
U.S. AIR FORCE
USAF
USAF
47085
46004

Convair WS-110



Section: Seaplane Bombers
Subsection: Martin Model 329 C-1

The Martin P6M Seamaster proved that high-speed turbojet aircraft could make functional seaplanes. While the P6M failed to enter service, largely for political reasons rather than technical failings of the design, Martin nevertheless studied more advanced seaplane concepts for the US Navy. Before the Seamaster was cancelled in August of 1959, Martin - aided by the NACA - devoted considerable time and effort to the Model 329.

Starting in 1954, the Model 329 program studied a wide variety of designs. The Model 329 A-series took the P6M and made it modestly supersonic (Mach 1.4) by lengthening and area-ruling the fuselage. Radius was intended to be 1500 nautical miles. The A-1 and A-2 designs were both powered by four afterburning J67 engines, two on the aft fuselage and two on the wings. The A-1 mounted the engines above the wings, while the A-2 mounted the engines below the wings. Variations continued up to A-12A, including using the Orenda PS-13 engine and the use of boron-based “zip fuel” for dash speeds up to Mach 2.

The Model 329 B-series increased speed to Mach 2.0 and range to 1900 nautical miles. The B-series was influenced by Martin work done on the Air Force WS-302 tactical bomber, and included six afterburning engines. The most unique configuration for the B-series was the Model 329 B-6D, which used a detachable sled for takeoff.

The Model 329 C-series was studied in greater detail, including wind tunnel and hydrodynamic testing. The C-1 and C-2 versions were the primary variants studied. Both had six non-afterburning Wright TJ-36 engines, two in a single nacelle on the aft fuselage, the other four atop the wings in individual nacelles. The C-1 and C-2 differed largely in having different fuselages; the C-1 had a conventional flying boat planing hull, while the C-2 had a retractable hydroski. While more complex than the planing hull, the hydroski had the advantage that, once retracted and faired in, the fuselage would be as aerodynamic as that of any supersonic aircraft.

The Model 329 C was designed to dash at Mach 2.0 at altitude and Mach 0.95 at sea level, with a total range of 1500 nautical miles. Weapons load could be 16,000 pounds worth of conventional bombs, but the primary intended load was a single 6,400 pound “special weapon” (an undefined nuclear device). Aircraft size and weight were constrained to roughly those of the P6M to facilitate easier handling with existing equipment and facilities.

In light of modern stealth design the Model 329 does not appear to be a particularly stealthy aircraft, but interestingly both C-models were designed to use contour breaks in their fuselages to reduce radar reflectivity.

The forward portion of the fuselage for both C-models contained the pressurized crew compartment, the radar systems and electronic equipment; the center section contained the fuel and the bomb chute. The bomb was loaded through a hatch in the upper fuselage forward of the wing. Defensive systems, including radar, chaff, jamming systems and three rearward-firing missiles, were located in the aft fuselage.

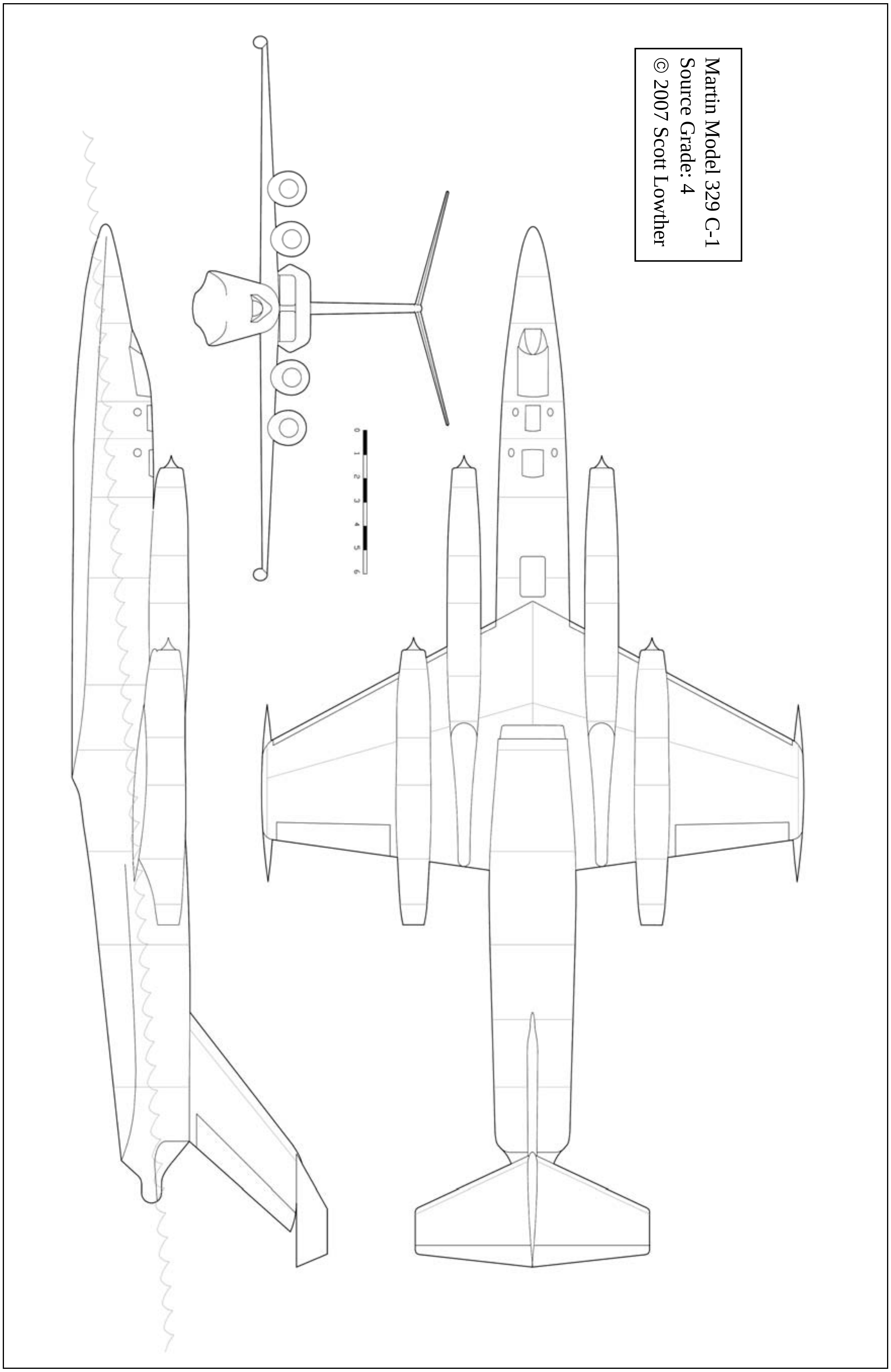
Range could be increased up to 50% by switching to more exotic fuels such as ethyldecaborane. At a takeoff weight of 220,000 pounds, the Model 329C-1 would require a takeoff run of 4,150 feet. The crew members were to be equipped with B-58-style individual escape capsules.

With the end of the P6M program, the Model 329 also came to a halt.

Model 329C-1

Span:	74.15 feet
Length:	143 feet
Wing Area:	1835 sq. feet
Takeoff gross wt:	220,000 lbs
Useful load:	110,580 lbs
Crew:	3

US Bomber Projects will present many more seaplane designs.


Martin Model 329 C-1
Source Grade: 4
© 2007 Scott Lowther

Section: B-70 Competitors and Evolution
Subsection: Convair WS-110A Concepts

One of the most amazing aircraft ever built was the XB-70 Valkyrie. WS-110A was the competition that led to the B-70. US Bomber Projects will describe a great many of the designs leading to the B-70.

Competing entries for the WS-110A, with the exception of Boeings (*NOTE: US Bomber Projects will present a large number of Boeing WS-110A designs*), are poorly documented in declassified literature. In the summer of 1955, Convair was invited to participate in the WS-110A program. However, Convair was soon to be heavily involved in the WS-125 program to develop a nuclear-powered bomber, and in the end chose to not compete. Nevertheless, Convair-San Diego did study a number of WS-110A designs, including some that were water-based. Unfortunately, information on Convairs studies is at best spotty, and not very detailed. It appears that the designs were largely very preliminary.

One available presentation covers several sea-basing concepts, not just for WS-110A, but several other applications as well. This provides information on a few ocean-going WS-110A concepts, but of course does not detail land-based designs. Similar studies were likely performed for landplane versions.

Convairs answers to the requirements of long range married with high over-target dash speeds were varied. The preferred sea-based WS-110A concept, for which a model or project number has not been discovered, involved the use of a large subsonic airplane towing a small supersonic bomber. Convair seemed to come to the conclusion – at least as of the time the presentation was put together in 1956 – that none of their other concepts would have the requisite range and dash speed.

The tow plane was fairly conventional in layout, featuring large, high aspect ratio swept wings. Engines were four Pratt & Whitney JT-9A turbojets. The bomber is clearly a derivative of the “Advanced B-58,” redesigned for aquatic takeoff and landing. In order to be able to land safely, the two wing-mounted engines could be pivoted upwards. This would also provide a substantial vertical thrust component. Large engines (three Allison 701C turbojets) were to be used, optimized more for Mach 3 dash, since low speed flight and cruise would largely be powered by the tow plane. As a result Mach 3+ performance in the dash phase was expected. A single internally carried missile comprised the armament, with a range of 500 n.m.

The aircraft would take off independently and rendezvous in flight. As soon as possible after takeoff, the dash plane would hook on to a tow line from the larger craft and then shut down its engines. The tow line would serve as a fuel hose… and the dash plane would transfer its fuel to the tow plane after engine shutdown. This would lower the weight of the towed bomber, and would help fuel the more efficient tow plane engines. A mission radius of 3250 nautical miles was expected.

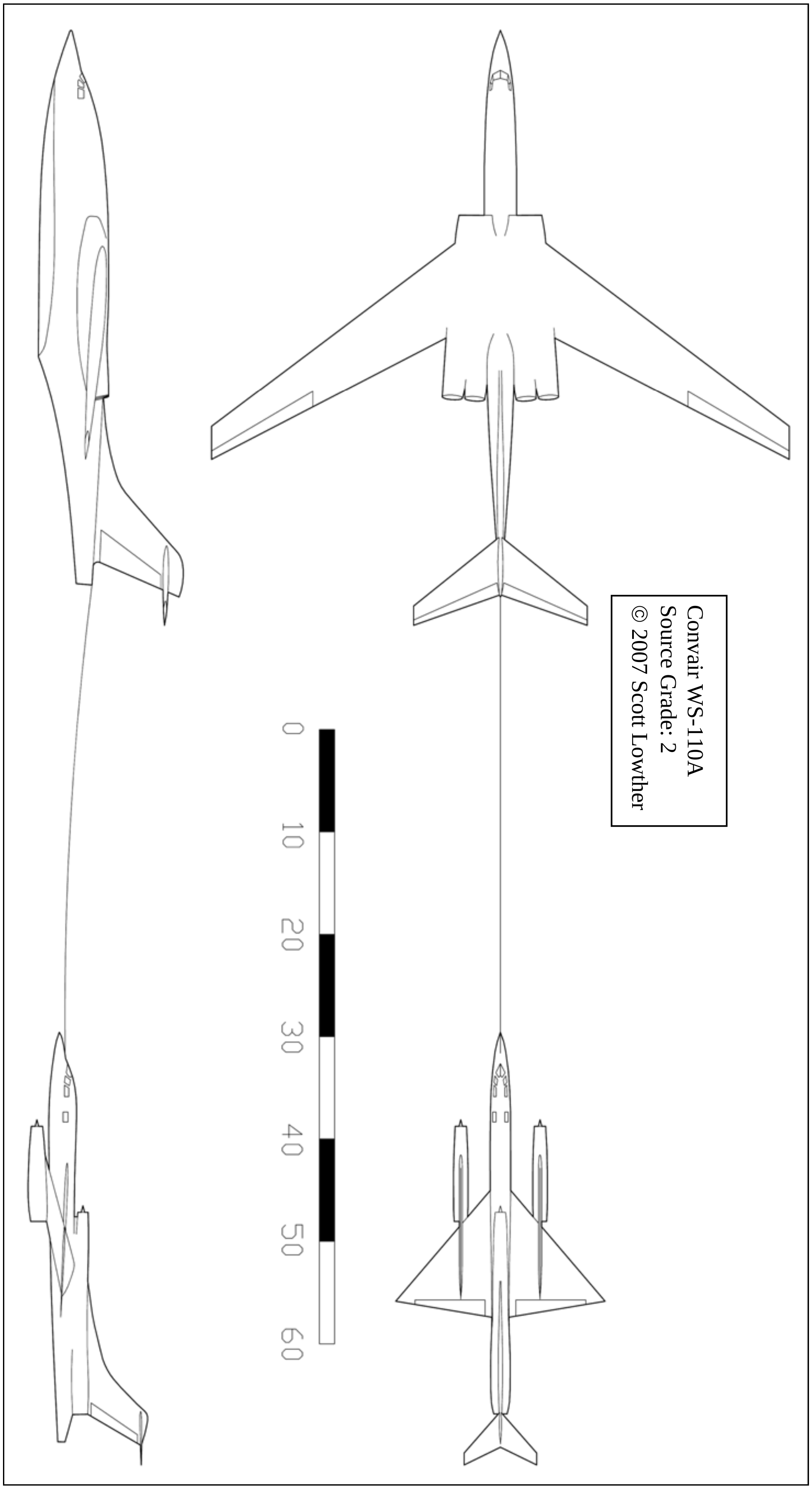
Prior to separation, the tow plane would pump fuel back to the bomber. At the appropriate point, the dash plane would restart its engines, fly its mission and then attempt to rendezvous again with the tow plane. Any remaining fuel would be transferred back to the tow plane. The planes would disconnect prior to landing (presumably with the bomber having enough fuel to effect a safe powered landing). The length of the towline is not given, but since it had to be a fuel line as well, it clearly could not have been too long.

Each aircraft would also be capable of serving independently. The tow plane could carry a sizable payload (either offensive weapons or cargo) a long distance at high subsonic speed; the dash plane could serve as a short-range supersonic attack craft.

It is very unlikely that this design was officially submitted.

	Tow Plane	Dash Plane
Span:	185 feet	59.5 feet
Length:	176.5 feet	125.25 feet
Gross Weight:	450,000 lbs	160,000 lbs

US Bomber Projects will show several other sea-based Convair WS-110A designs, including a “piggyback” two-stage design and a flying-wingtip design.


Convair WS-110A
Source Grade: 2
© 2007 Scott Lowther
0
10
20
30
40
50
60

Section: Nuclear Powered Bombers
Subsection: Lockheed NEPA Configuration

Almost from the moment that the first atomic bomb was detonated, the United States government wanted to harness nuclear energy for the propulsion of aircraft. A bomber that used atomic power would, in theory, be able to remain aloft virtually indefinitely; this promise led to years of study. Several programs, such as NEPA, ANP, WS-125 and others, extending from 1946 into the 1980's, produced a myriad of nuclear powered bomber designs… subsonic, supersonic, landplanes, seaplanes, manned, unmanned, conventional layouts, flying wings… US Bomber Projects will present dozens of such designs, the bulk of which have never before been shown in such a public publication.

In May of 1946, the United States Air Force initiated the Nuclear Energy for the Propulsion of Aircraft (NEPA) program. NEPA was intended to provide the basic knowledge required for the development of nuclear powered bombers and transport aircraft,

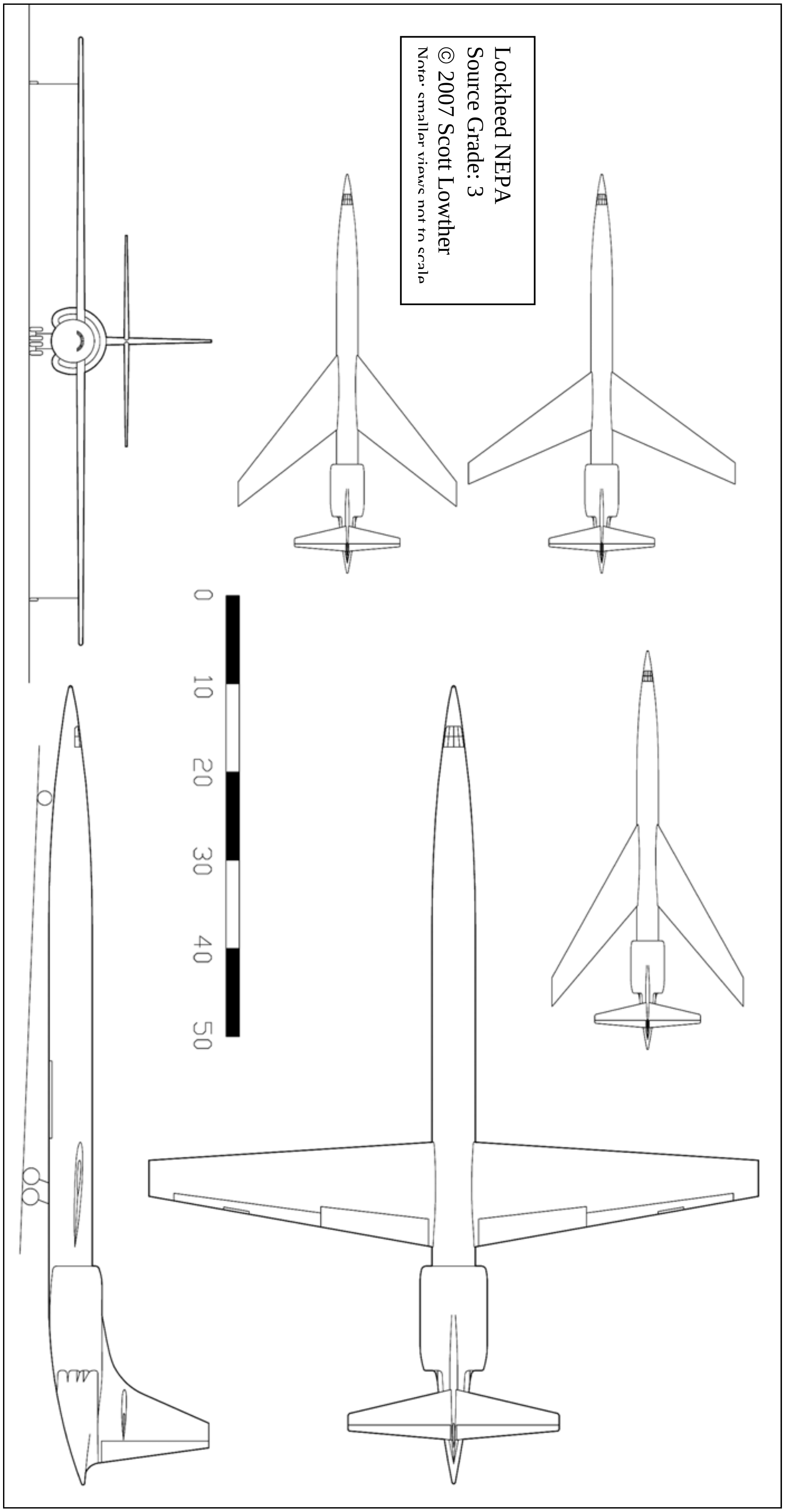
The contract to oversee the NEPA program was initially awarded to the Fairchild Engine & Aircraft Company, to be carried out at the Oak Ridge National Laboratory. Other companies added their expertise, including General Electric, Allison, Westinghouse and Northrop. During the span that NEPA was operational, Fairchild developed a number of preliminary bomber designs, including B-52 variants and clean-sheet designs.

The Lockheed Aircraft Corporation was also tasked with preliminary aircraft design for NEPA. A small project that ran from January to March of 1950 (consuming a total of 2.1 man-months… a very minor study) resulted in a series of aircraft designs based on a common core fuselage.

The generic design was just a planned starting point… many wing areas, wing sweeps, engine numbers, gross weights and maximum speeds and altitudes were considered, but solely as a guide for future study. It should be noted that the design shown – the only one so far discovered in declassified literature – does not seem to exactly match any of those presented in the data table. Given that the data covers airplane types "A-5" through "A-10," it is likely that the drawing represents an A-1 through A-4 configuration. A common feature was described as the 165-foot separation distance between the crew cabin and the reactor. The reactor was immediately ahead of a ring of turbojets; this design used eight jets.

Airplane type	A-5	A-6	A-7	A-8	A-9	A-10
Designed for	Reasonable landing and take-off characteristics	Reasonable landing characteristics and ceiling above 50,000 ft.	Reasonable landing characteristics and high speed at 50,000 ft.	High speed at medium altitudes	High speed at low altitudes	High speed at 50,000 ft.
Gross weight	600,000 lb.	475,000 lb.	550,000 lb.	540,000 lb.	520,000 lb.	514,000 lb.
Wing loading	100 lb/sq.ft.	100 lb/sq.ft.	100 lb/sq.ft.	200 lb/sq.ft.	400 lb/sq.ft.	200 lb/sq.ft.
Wing area	6000 sq.ft.	4750 sq.ft.	5500 sq.ft.	2700 sq.ft.	1300 sq.ft.	2570 sq.ft.
Maximum thrust output	200,000 lb. (sea level)	55,000 lb. (50,000 ft.)	82,500 lb. (50,000 ft.)	200,000 lb. (sea level)	200,000 lb. (sea level)	82,500 lb. (50,000 ft.)
Number of engines	8	8	12	8	8	12
Sea level maximum Mach No.	1.055	0.905(0.902)	0.970	1.250(1.103)	1.500(1.120)	1.000(0.965)
Wing sweep	60°	25°(35°)	60°	60°(50°)	45°(15°)	60°(45°)
Maximum Mach No. at 35,000 ft.	1.080	1.050(0.952)	1.120	above 1.500	above 1.500	1.450(1.245)
Wing sweep	60°	60°(35°)	60°	50°	15°	60°(45°)
Mach No.* at 50,000 ft.	----	0.880	1.020	----	----	above 1.500
Wing sweep*	----	35°	60°	----	----	45°

* Ceilings less than 50,000 feet.


Lockheed NEPA
Source Grade: 3
© 2007 Scott Lowther
Note: smaller views not to scale
0
10
20
30
40
50

Section: B-1 Competitors and Evolution
Subsection: North American D436-21

The development of the B-1 bomber is a curious collection of the well-known and the obscure. Arising from a long string of programs… SLAB (Subsonic Low Altitude Bomber), ERSA (Extended Range Strategic Aircraft), LAMP (Low Altitude Manned Penetrator), AMP (Advanced Manned Penetrator), AMPSS (Advanced Manned Precision Strike System) and finally AMSA (Advanced Manned Strategic Aircraft), the B-1 concept went through years of competition and re-conceptualization.

Between the beginning of the SLAB program and the end of the AMSA program, many companies (along with numerous design bureaus in the Air Force) studied many configurations. And despite the many thousands of designs put forward, very few have been made public. This has made a true design history of the B-1 program somewhat spotty.

AMSA (WS-139A) was the final and most important study program prior to the B-1 program proper. Beginning in 1965, it ended in 1969 with the formal Request For Proposals for the B-1 program. The AMSA program had a number of requirements, such as being a large aircraft capable of carrying standoff attack missiles, the ability to perform both high and low altitude penetration, having highly swept wings for high speed at low altitude and a crew of four.

Many of the AMSA and precursor designs feature variable geometry wings, a feature derived in part from the F-111, and later found on the actual B-1 bomber. This feature, while adding to weight, cost and complexity, greatly increased operational flexibility when compared to designs such as the B-70. One such design was the North American Aviation D436-21 from 1967. This was the AMSA Phase I basepoint design for trade and integration studies, and, while quite different from North Americans final B-1, it is recognizable as an ancestor.

The D436-21 featured wings capable of substantially greater sweep range than not only the B-1, but greater than any aircraft actually built. For takeoff and landing the wings would be extended with a sweep of 20°; but for Mach 2.2 dash, the wings would sweep back beyond 90° to a full 105.5°. This would turn the vehicle into a lifting body with minimal drag at high speed. The control surface on the wing would be useless in this configuration; direction would thus be controlled by the tail surfaces.

As with the B-1, the D436-21 was to be equipped with an ejectable cockpit capsule. Also as with the B-1, the D436-21 would have four turbojets; but instead of two discrete engine pods, the –21 blended the engines into the aft fuselage, using underwing, fuselage-side inlets. The design had two munitions bays, one 360 inches long ahead of the wing pivot position, and one 215 inches in the aft fuselage. Armament would have included conventional bombs, along with SRAMs.

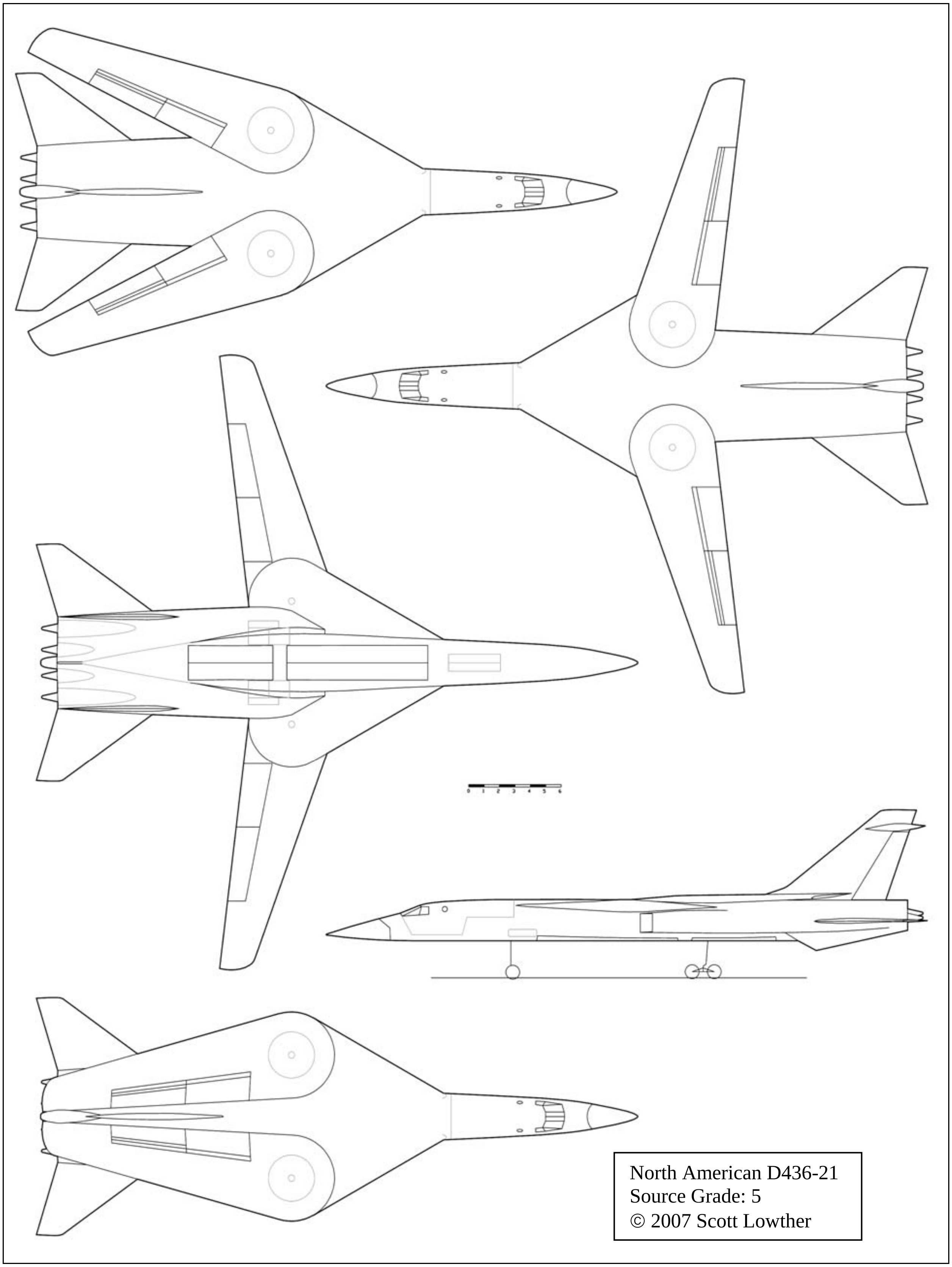
The D436-21 would have been capable of refueling in flight to extend range and duration.

The D436-21 was followed by the D436-24, which was largely similar but featured a number of improvements. The Phase II point design was the D458-13D, which was a substantially different design.

North American D436-21

Span (20° sweep):	130.7 feet
Span (45° sweep):	110.1 feet
Span (75° sweep):	65.4 feet
Span (105.5° sweep):	44.2 feet
Empty weight:	123.340 lbs
Takeoff Gross Weight:	333,00 lbs
Max Mach number:	2.2
Max S.L. Velocity:	1350 ft/sec
Engines:	4 GE1-9F2F
Range:	5000 n. mi.
Payload:	26,100 lbs nominal, 104,000 lbs max

While the B-1 story is incompletely declassified, a number of very rarely seen AMSA designs will be presented in US Bomber Projects.


North American D436-21
Source Grade: 5
© 2007 Scott Lowther

Section: Hypersonic Bombers
Subsection: Boeing Model 813

Since the 1940's, many bombers have been designed for extreme speed. The combination of hypersonic speed (defined as Mach 5 or faster) and extreme altitude leads to bombers that can not only strike distant targets very quickly, but are also virtually impossible to intercept. US Bomber Projects will feature a number of hypersonic bombers, including manned and unmanned, scramjet and rocket-powered designs.

The Boeing Model 813 series was designed in 1958-1959 as part of the SR-170 "Extended Range High Speed Strategic Bomber" study program. The resultant designs were largely multi-stage manned vehicles capable of hypersonic speeds, with unmanned boosters and manned dart-like ramjet and rocket powered second stages.

The Model 813-1036 was a typical specimen of the series. It included a ramjet-powered manned booster and an unmanned turbojet powered booster. Designed to cruise at Mach 6+ above 80,000 feet, it could be launched either from a 10,000 foot runway or from fixed emplacements with the assistance of assist take-off rockets. The turbojet booster would be remotely controlled, and would fly back to base (if possible).

Two separate bomb bays were installed in the Model 813. The forward bomb bay was expected to generally carry two decoys (specially designed to match the Model 813 in performance and signature), while the aft bay carried the warload. Weapons load could be four 2-megaton air-to-surface missiles (Model 813-5000), eight two-megaton bombs, or one rather remarkable 50 megaton bomb. It should be noted that the United States never detonated a bomb with anything remotely like that yield, nor would a weapon of that magnitude have any true military purpose. A far more efficient use of nuclear resources would be to use a number of substantially lower-yield weapons instead of one monster bomb.

Being a ramjet powered vehicle, the Model 813 obviously would have had difficulty in ferrying from place to place. Control technology of the time would have permitted the turbojet powered booster to return to the launch base, but would not have permitted safe and reliable transportation from airbase to airbase. Consequently, alternate transportation systems would be required. Both the booster and the bomber were expected to be transportable both by road and train; this would certainly have been an interesting sight. One of the more interesting notions was to use the Model 732-10-2 vertical takeoff and landing heavy cargo lifter (*this remarkable design will be shown in US Bomber Projects*) for invulnerable and fast transportation.

The Model 813 was expected to cost $14.1 billion to develop, with $1.23 billion required for annual operating costs.

The Model 813 would have had a problem common to multi-stage aircraft: difficulty in training and practice, and severe difficulty in finding alternate roles. The bomber itself, having nothing but ramjets (which do not work at slow speed), would be useless and inert without a booster. So to fly at all, the booster – or some rough equivalent -would have to be used.

The ramjets are not described in any detail in the available documentation. However, chances are good that they would have actually been scramjets, given the Mach 6 cruise speed.

Boeing Model 813-1036 (bomber)
Length: 117' 10"

Span:	72' 0"
Wing Area:	4820 sq. ft.
Powerplant:	2 41" dia ramjets
Gross Weight:	300,000 lbs
Military Load:	25,000 lbs
Crew:	3

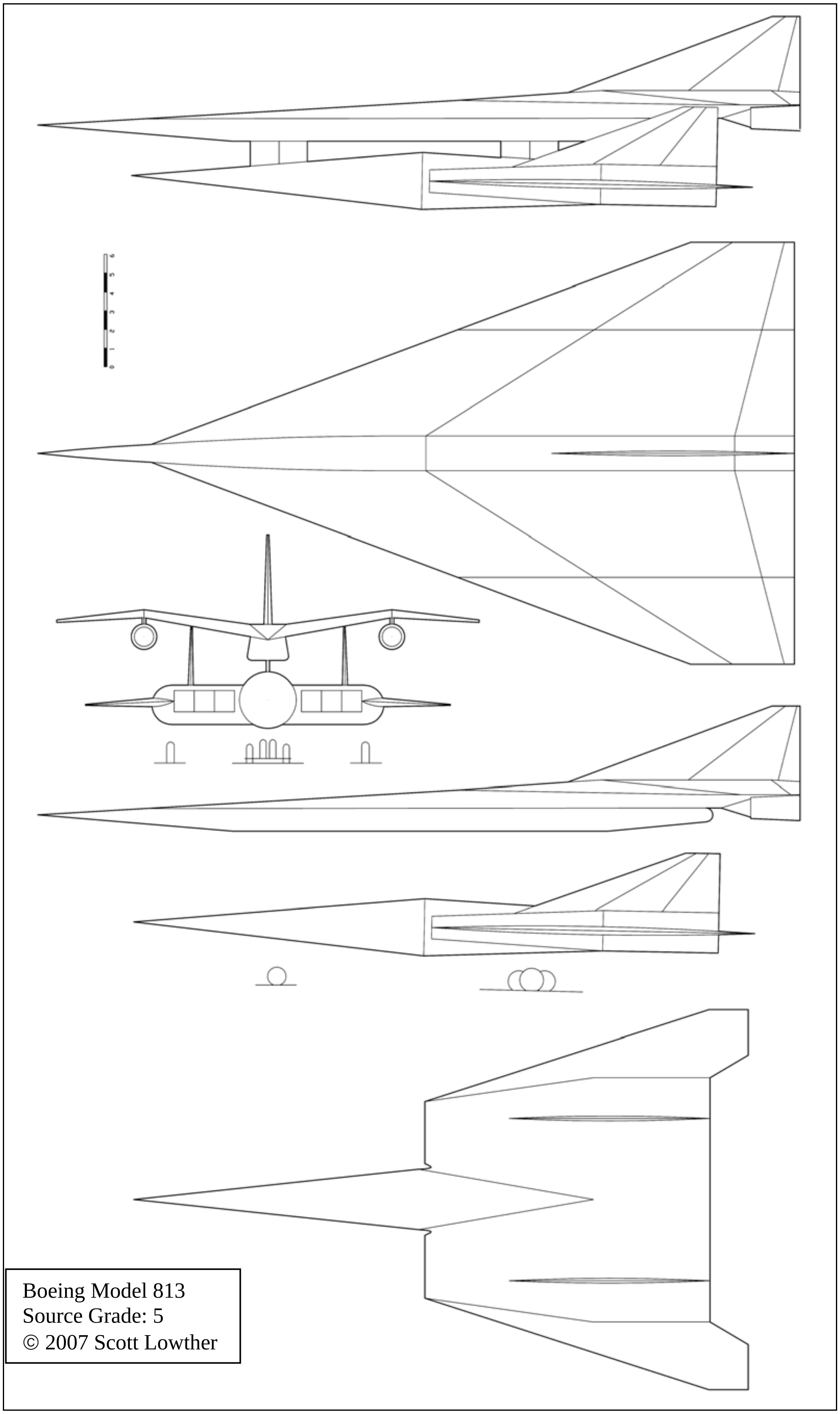
Boeing Model 813-2032

Length:	109' 5"
Span:	64' 7"
Wing Area:	2600 sq. ft.
Powerplant:	6 turbojets
Gross Weight:	175,000 lbs

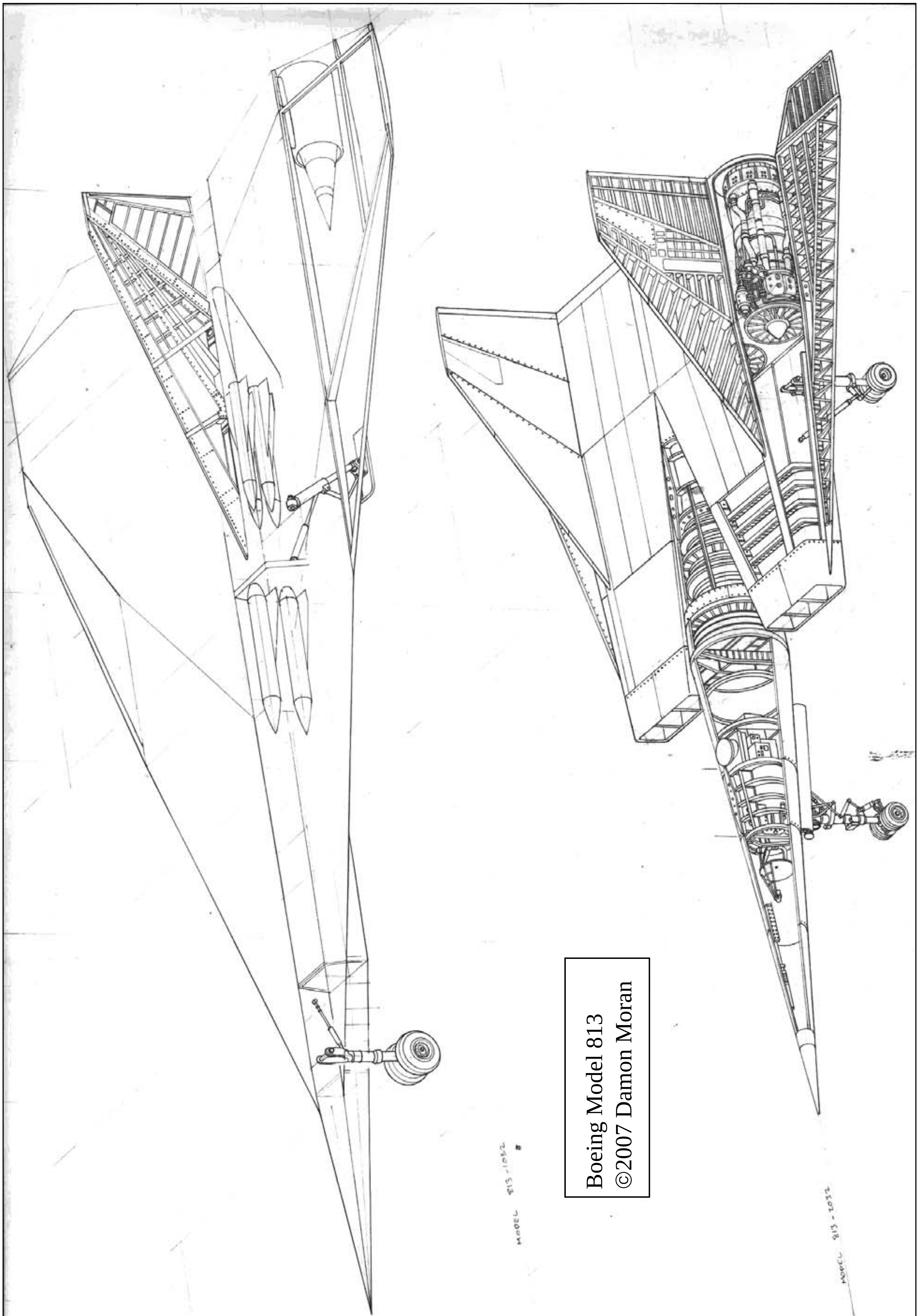
Combined Vehicle

Gross weight:	475,000 lbs

The Boeing Model 813 section will include several other Model 813 designs, as well as inboard profiles and perspective views.



Boeing Model 813
Source Grade: 5
© 2007 Scott Lowther


Boeing Model 813
©2007 Damon Moran

Section: Missile Launchers
Subsection: Lockheed CL-292-6

More than a few aircraft have been designed specifically to carry missiles rather than bombs. Missiles have the advantage of range, which means that the carrier aircraft might not need to actually penetrate enemy airspace. Several missile carrying aircraft were designed that would never need to leave US airspace at all; the plane provides a mobile launch pad for an intercontinental-range missile.

A number of such missile carriers will be presented in US Bomber Projects.

The Lockheed CL-292-6 is one of those hard to classify designs. Dating from 1954, it does not appear to have been designed to a specific requirement, and certainly does not seem to be a competitor for an aircraft role like the B-70 or B-1. Also, being nuclear powered, it could as easily go in the Nuclear Powered Bombers section.

The CL-292-6, designed for the US Air Force, was certainly a unique concept. A large plane with a 254-foot wingspan, it was meant as a flying DEW (Detection and Early Warning) line post. Having nuclear turboprops and large, reasonably high aspect ratio wings, duration on station would have been considerable. As well as the large radar rotadome on the top of the craft, missiles would be carried under the wings and within the fuselage. Four "Mark II" missiles would be carried under the wings, and three missile bays – one aft, two forward – would each carry fourteen "Mark I" missiles. Further information on the missiles is lacking; all that can be discerned is that the Mark II missile was an airbreathing supersonic cruise missile of some type. The Mark I missiles are not shown, so little about them can be determined other than they were smaller than the Mark II missiles. Most interestingly, four CL-307 parasite fighters would also be carried. These F-104-derived planes were to be carried under the wings; the pylons holding the planes completely covered the cockpit canopies, allowing the pilots to enter and exit their fighters while the mothership was in flight. The total crew of the craft was an impressive 33. Of these, four were obviously pilots for the interceptors… but the roles of the rest of the crew can really only be guessed at. With 33 crew, it is likely a safe bet that the plane was intended to stay in the air for days at a time, with several duty shifts.

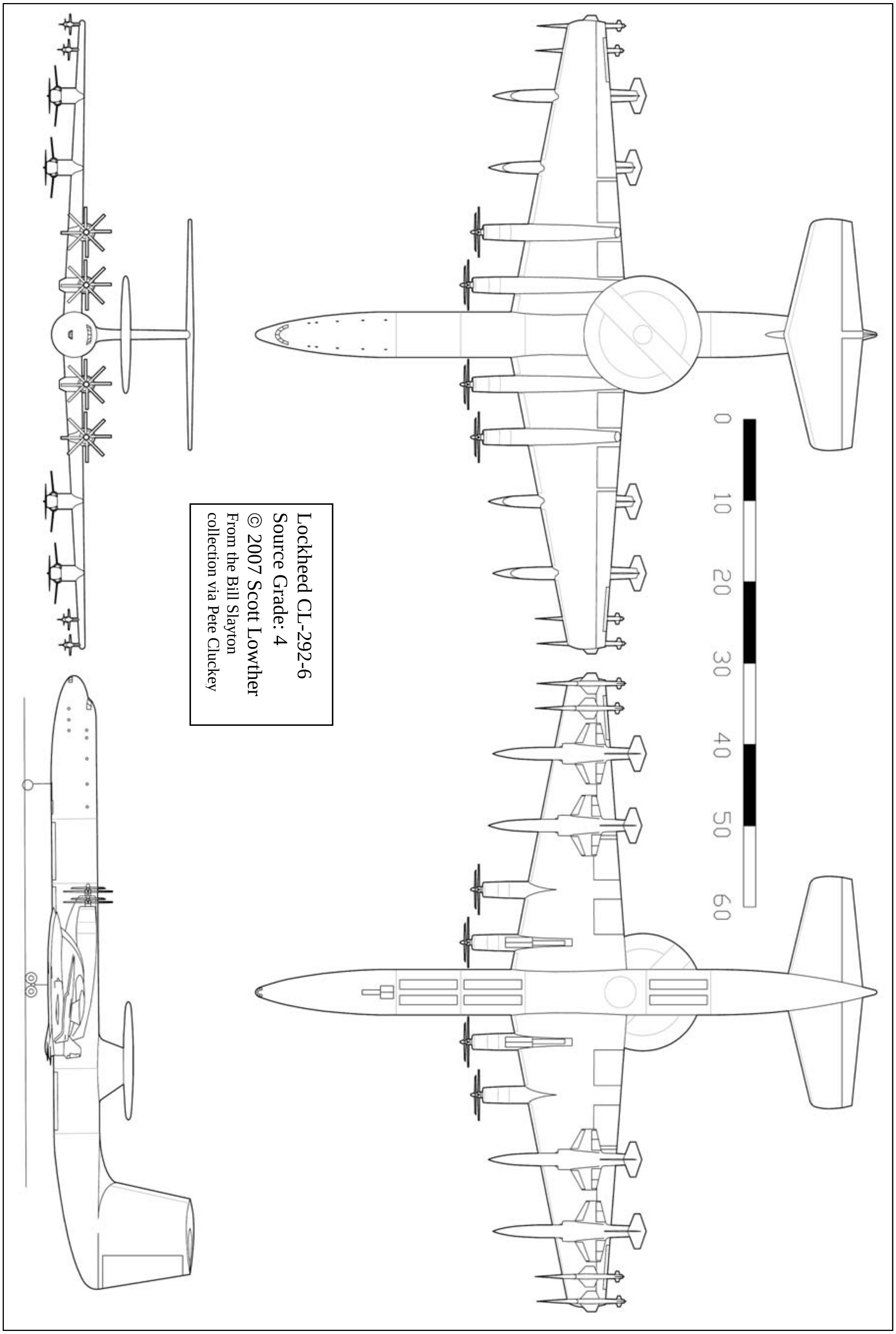
The 90 megawatt reactor was located in the aft fuselage, just forward of the radome. The reactor provided the thermal energy required by four 34,200 shaft horsepower turboprop engines, each equipped with 20 foot diameter contra-rotating propellors.

The precise role of the CL-292-6 is a bit of a mystery. Clearly it was meant as an offensive weapon; the "Mark II" missiles can be nothing other than cruise missiles of some type. The CL-307 parasite fighters, however, served a purely defensive role, being armed solely with Sidewinder air-to-air missiles. The "Mark I" missiles, however, can be understood only by their size and number. They may have been either air-to-air or air-to-ground missiles; the size of these missiles must have been impressive given the length of the missile bays (nearly 8 meters in length). This means fairly large, possibly nuclear-tipped missiles of considerable range, quite possibly meant to take out Soviet bomber formations. Alternatively, perhaps the "Mark I" missiles were to be similar to modern SRAM missiles or even small turbojet cruise missiles. Similar designs to the CL-292 show what are clearly long-range attack missiles, so that seems the more likely prospect. Without further information, this is sadly nothing but pure speculation. Another example of a tantalizing design with annoyingly slim documentation.

Lockheed CL-292-6

Span:	254 feet
Wing Area:	8000 sq feet
Fuel Load:	31,720 lbs
Empty Weight:	404,213 lbs
Gross weight:	548,500 lbs

As well as the three-view, Lockheed CL-292-6 will likely be illustrated with a perspective view and a detailed drawing of the CL-307 parasite fighter, along with further CL-307 information. Several related designs will also be presented.


Lockheed CL-292-6
Source Grade: 4
© 2007 Scott Lowther
From the Bill Slayton
collection via Pete Cluckey
0
10
20
30
40
50
60

Section: Future bombers
Subsection: Northrop QSP

In November 2000, the Defense Advanced Research Projects Agency awarded to Boeing Lockheed Martin and Northrop Grumman Phase I system integration study and technology development contracts for the Quiet Supersonic Platform (QSP) program. The QSP effort was aimed at technology supporting the development low-sonic-boom and efficient supersonic strike, bombardment and passenger aircraft.

The goal was an aircraft that could fly supersonically with sonic boom overpressures less than 0.3 psi, unrefueled range of 6,000 nautical miles and low operational cost. This would be a recipe not only for a stealthy bomber, but also a commercial or corporate transport that could fly over the continental United States. Testing in the 1950s and 1960s had shown the sonic boom from conventional supersonic aircraft to be disturbingly loud to the general public, and this helped to kill the Boeing SST and prevent the Concord from flying cross-country routes.

To reduce sonic boom, careful shaping of the aircraft is required. Many quite bizarre geometries were evaluated by the contractors, including multi-body layouts, X-wings, straight wings and more. In the end, Lockheed produced a design that was not greatly unconventional, Northrop-Grumman produced a design that looked like it was going fast when it was sitting still, and Boeings design looked like it couldn't go fast if it was shot out of a cannon.

The Northrop design featured an extremely long and thin fuselage with a fineness ratio of 24, and so long and thin of a nose that the cockpit was set approximately 55 feet aft. Also featured were an engine pod above the rear fuselage, highly swept wings and aft stabilizers that were swept forward and joined with the wings. This joined-wing configuration added greatly to the structural strength of the whole assembly. The overall design of the craft was driven not only by the requirement for quiet supercruise over a long range, but also to be "dual relevant." The same basic airframe could be used for either corporate transport or for the Future Strike Aircraft or Next Generation Bomber military strike requirements.

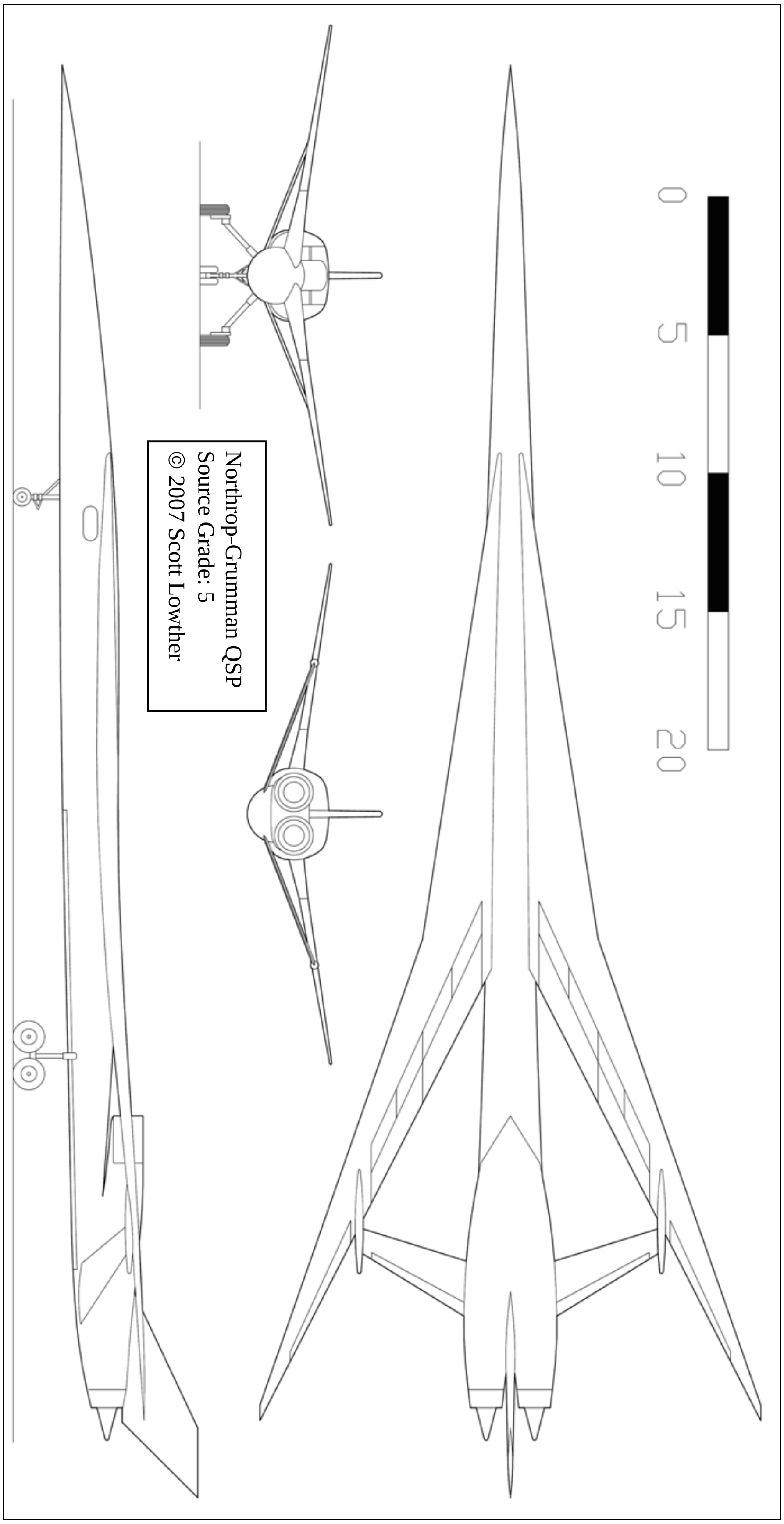
To reduce the sonic boom, the aircraft used careful fuselage and wing shaping to erase the rapid pressure rise supersonic aircraft typically form at the nose and tail, and smooth out the "N-wave" profile of a normal sonic boom. To prove that the aircraft shaping would do the job, Northrop Grumman modified an F-5 fighter into a Shaped Sonic Boom Demonstrator.
Testing in 2003 showed that an all-new, very long and rather deep nose produced an approximately 25% decrease in the strength of the boom as compared to a conventional F-5.

The Northrop QSP was equipped with two bomb/payload bays 5 feet wide, 2.67 feet tall and 27.3 feet long. Each contained 10,000 pounds of payload… bombs or missiles. Thrust was to be provided by two General Electric variable cycle engines with an assumed 20% increase in supercruise efficiency when compared to existing engine technology.

Northrop "Dual Relevant" QSP

Length:	169.9 ft
Span:	57.7 ft
Cruise speed:	Mach 2.4
Range:	6,000 n.m.
Payload:	20,000 lbs
Main Wing Area:	1267 sq. ft
Main wing aspect ratio:	2.63
Aft Wing Area:	190 sq. ft

US Bomber Projects will present further QSP design information, including information on the Boeing and Lockheed concepts.


0
5
10
15
20
Northrop-Grumman QSP
Source Grade: 5
© 2007 Scott Lowther